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The Lifestyle-integrated Functional Exercise Program for Older Adults

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This thesis, written under the direction of Dr. Kitsum Li, OTR/L, CSRS and approved by the chair of the program, Dr. Ruth Ramsey, OTR/L, has been presented to and accepted by the faculty of the Occupational Therapy Department in partial fulfillment of the requirements for the degree of Master of Science in Occupational Therapy. The content and research methodologies presented in this work represent the work of the candidates alone.

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Abstract

According to the Centers for Disease Control and Prevention, falls are the most common cause of fatal and non-fatal injuries among older adults over the age of 65 (Centers for Disease Control and Prevention [CDC], 2009). Falls can lead to a myriad of traumatic physical and emotional consequences. Integrated exercise programs such as the Lifestyle-integrated Functional Exercise (LiFE) program are effective in preventing falls and increasing fall efficacy in individuals who have previously fallen (Clemson et al., 2012). The purpose of our study was to examine if the LiFE program is as effective in reducing fall risk and increasing fall efficacy for non-fallers as it is for fallers. Due to a small sample size of three older adults residing in two independent living residential facilities, the results from our study are inconclusive. The results show that participants were able to increase or maintain their physical fitness and fall efficacy, as well as make improvements in their balance. Moreover, the participants' testimonials and progress forms collected six-months after the beginning of the program indicate that the LiFE program may have been effective in allowing integration of balance and strengthening exercises into habits occurring in daily activities.

Introduction

According to the Centers for Disease Control and Prevention, falls are the most common cause of fatal and non-fatal injuries among older adults over the age of 65 (Centers for Disease Control and Prevention [CDC], 2009). A fall episode can cause a range of physical consequences, including lacerations, hip and spine fractures, traumatic brain injuries, and death (CDC, 2009). The financial impacts of falls are projected to cost over $60 billion dollars per year, and continues to increase as the population of older adults continues to grow (CDC, 2009). Furthermore, older adults who experience one or more falls are likely to develop a fear of falling. This fear of falling may then inhibit older adults from engaging in meaningful activities as they may now perceive the activities as dangerous (Boyd & Stevens, 2009; Lach, 2005).

Given the many negative consequences of a fall episode, researchers have strived to identify the best fall prevention programs. Multiple studies have determined that exercise programs can prevent falls by improving balance and strength, as well as increasing fall efficacy, which are three of the known risk factors for falling (Choi, Moon, & Song, 2005; Clemson et al. 2012; Hedley, Suckley, Robinson, & Dawson, 2010; Hess & Woollacott, 2005; Lin, Wolf, Hwang, Gong & Chen, 2007; Skelton, Dinan, Campbell & Rutherford, 2005). However, while traditional exercise programs may address the risk factors that lead to falls, the older adults often have poor compliance and are not motivated to continue with the exercises in the long run (Lord et al., 2005; Newson & Kemps, 2007).

In contrast to traditional exercise programs, integrative exercise programs aim to improve balance and strength by teaching older adults to incorporate exercises into their daily lives. Compliance to these programs is greater because the exercises habituate as part of an overall lifestyle routine (Opdenacker, Boen, Coorevits, & Delecluse, 2008). Clemson et al. (2012)

developed The Lifestyle integrated Functional Exercise (LiFE) program and have proved that integrating balance and strengthening exercises into daily routines could reduce the rate of falls in older adults who have previously fallen. While the LiFE program has proven effectiveness in older adults with fall history, it is not known whether the program will reduce fall risk in older adults who have not previously fallen. Since even a single fall episode can lead to physical consequences and development of fear of falling, a fall prevention program for older adults who have not previously fallen is as important as one for those who have fallen. By decreasing fall risk and fall-related consequences that could limit older adults' engagement in meaningful activities, the LiFE program could become a valuable intervention used in the field of occupational therapy.

Review of Literature

According to the CDC, one out of three older adults over the age of 65 fall each year (CDC, 2009). A fall is defined as "an unexpected event in which the participant comes to rest on the ground, floor, or lower level" (Gillespie et al., 2009). There are many factors that need to be explored when implementing a fall prevention program in order to decrease the risk of falling in older adults living in the community. This literature review examines the incidence and consequences of falls, as well as some of the specific risk factors that may lead to falls in older adults. Next, the literature examines the benefits of exercise programs to reduce falls and improve fall efficacy with older adults who have previously fallen, as well as those who have not fallen. The literature review then explores factors of traditional and integrated exercise programs to increase motivation and compliance in older adults. Finally, the LiFE program and its relationship to this study, as well as assessments that can be used to measure balance and fall efficacy, will be discussed.

Consequences of Falls in Older Adults

Falls can cause a wide range of health concerns for older adults, including fatal and non-fatal injuries such as hip fractures, traumatic brain injuries, and head traumas. Previous research has suggested that men have a 41% higher risk of dying from a fall than women. However, women incur fall-related injuries at a rate of 40-60% higher than men and are 81% more likely to be hospitalized for their fall episode (CDC, 2009).

Falls are not only physically damaging for the individual, but are also financially taxing for the nation. Nearly a quarter of fallers seek medical attention for injuries after experiencing a fall episode. Financially, fatal fall injuries are estimated to cost more than $179 million dollars while non-fatal fall injuries are projected to cost more than $19 billion dollars annually (Stevens, Corso, Finkelstein & Miller, 2006). Fractures and non-fatal injuries occurring in the upper and lower extremities account for the most frequent and costly injuries (Stevens et al., 2006). The financial impacts of fall-related injuries among older adults highlight the need for fall prevention programs.

Falling may also directly impact one's functional abilities. Older adults who fall experience a decline in function, such as dressing, rising from sit to stand, walking and climbing stairs. Social activity, as well physical activity, also declines after falling (Stel, Smit, Pluijm & Lips, 2004). Older adults who have fallen one or more times may be more likely to experience another fall within a year in comparison to those who have not fallen (Boyd & Stevens, 2009). This is especially concerning as studies have shown that experiencing two or more falls is related to developing a fear of falling, regardless of whether or not the older adult acquired an injury from the fall incident (Boyd & Stevens, 2009; Lach, 2005). This fear of falling may then limit an individual’s participation in functional and meaningful activities.

Both fall injuries and fear of falling can limit independence and prevent older adults from engaging in meaningful occupations. Furthermore, falls can create physical, emotional, and financial concerns for older adults. Therefore, it is important for occupational therapists to implement treatment strategies that can reduce fall risk and promote fall efficacy when working with older adults.

Fall Risk Factors

There are several risk factors that attribute to fall risk in older adults, and they are categorized into two categories, intrinsic and extrinsic risk factors. Intrinsic risk factors refer to any change that the person experiences that may contribute to a fall (Todd & Skelton, 2004). Some examples are balance, weakness, low cognition, risk-taking behaviors, vision, illnesses, and diseases. Extrinsic factors are components of the older adult's environment that might create a fall risk. Some examples of extrinsic factors include bad lighting in the house, unstable footwear, or uneven ground. Both intrinsic and extrinsic factors are dangerous, and their combined impact often lead to falls in older adults.

Intrinsic risk factors. Intrinsic risk factors include any aspect of an individual that may contribute to his or her fall risk. According to Huang (2004), there are six different categories of intrinsic factors; demographics, illness, medicine, balance measurement, cognitive status, and fear of falling. Many intrinsic fall risk factors are associated with normal aging, such as vision impairments and decreased muscle strength (Painter & Elliot, 2004).

Balance and weakness. Many studies have shown a strong correlation between decreased balance and falls among older adults. (Cho et. al., 2004; Kulama et al., 2009) However, few studies have researched the relationship between balance and other intrinsic factors. Kulmala et al. (2009) researched the correlation between falls and intrinsic risk factors such as poor balance, visual acuity, and hearing impairments, in older adult women. The study assessed balance, vision, and hearing in 428 female participants over the course of a year. Results showed that almost half of the women had experienced a fall within the year, and that more impairments in the three areas of balance, vision, and hearing correlated with more falls. Results also showed that balance can strongly affect a female older adult's risk of falling, while other intrinsic factors may affect balance. Many of the participants who showed decreased balance also had impairments in vision and hearing. These results indicate that many intrinsic risk factors for falls are often related and reciprocal, and can affect each other (Kulama et al., 2009).

Cho, Scarpace, and Alexander (2004) conducted a cross-sectional study to examine the correlation between falls, balance, and gait. One hundred and seventy-seven older adults with mild balance impairments were recruited to participate in a balance and fall reduction program. Researchers measured the distance that each participant was able to step out and return to his or her original stance, or maximal stepping length (MSL). They also performed the rapid step test (RST), which measures the length of time taken to walk 24 steps using MSL length. These results were correlated with the frequency of falls each participant had, along with leg strength, fall efficacy, and balance. The results showed that having a low MSL was significantly correlated with being a frequent faller. This study also found that older adults who experienced a fall would limit the length of their steps. Having a narrower base of support while ambulating can, in turn, lead to risk of falls. Therefore, measuring MSL and RST can help predict the gait, strength, and their relationship to fall risk in older adults (Cho et. al., 2004).

Moreland, Richardson, Goldsmith and Clase (2004) discovered that muscle weakness is a modifiable risk factor for falls that, if addressed, can improve balance and strength in older adults. They found that not only lower, but also upper extremity weakness may increase an older adult's risk for falling. Working on balance, flexibility, endurance, and resistance can increase muscle strength and therefore, ultimately decrease fall risk (Moreland et al., 2004).

Extrinsic risk factors. Extrinsic risk factors include any part of an older adult's environment that could affect his or her risk of falling. Studies have shown that between 30% and 50% of falls in older adults are due to environmental factors (Todd & Skelton, 2004). Examples of extrinsic factors include rugs on the floor, stairs, uneven ground, bad lighting, and pets. Extrinsic factors may also include unsafe footwear and clothing, as well as improper use of assistive devices (Todd & Skelton, 2004). Additionally, Painter and Elliot (2004) found that many older adults fall because they did not use their assistive devices properly. Older adults may set up the device wrong and consequently fall while using it. Furthermore, large assistive devices can take up a lot of space in an individual's house, creating clutter, which is also a known fall risk factor for older adults (Huang, 2004).

Huang (2004) categorized older adults into groups of fallers and non-fallers and used a checklist to identify extrinsic risk factors. Using 405 participants, the study identified four different categories of extrinsic factors: social support, footwear, environment, and fear of falling. Compared to non-fallers, fallers' homes had a greater amount of extrinsic risk factors such as unsafe surfaces. Older adults who had lower lighting in their kitchens and clutter in rooms, entryways, or backyards, were also at a higher risk for falling (Huang, 2004).

Extrinsic factors can also include footwear. Tencer et al. (2004) conducted a study including 1,371 participants, 327 of whom were fallers. Their footwear was measured in terms of lateral stability, position, and shoe surface. Researchers found that higher heel height correlated with a higher risk of falling, and that people wearing shoes that had more contact with the ground were at less risk for falling. Tencer et al. (2004) concluded that lower shoes with more contact area could help older adults reduce the risk of falling.

Benefits of Exercise To Address Strength and Balance

Studies have demonstrated that fall prevention programs are effective for older adults that have already experienced a fall (CDC, 2009). According to the CDC (2009), the most effective fall risk prevention programs combine education about fall risk reduction, as well as physical training classes to address balance and strength. Exercise programs involving strength and balance training are an effective way to reduce the risk of falls in older adults that have already experienced a fall (Lin et al., 2007; Skelton et al., 2005; Clemson et al., 2004). However, there is a lack in research to determine the effectiveness of exercise programs in people who have not experienced a fall.

Many studies have shown that exercise is an effective way to address the intrinsic fall risks of older adults, particularly those who have previously fallen. Lin et al. (2007) conducted a four-month randomized controlled trial with 150 community dwelling participants, ages 65 and older, who had experienced a fall. The interventions consisted of education, home assessment or exercise program. The education intervention included pamphlets regarding fall prevention strategies, and the home assessment intervention included consultations to identify home environmental fall hazards. The exercise intervention consisted of stretching, strength training and balance. After the intervention, prior fallers who participated in the exercise intervention increased in functional reach distance, balance and gait scores (Lin et al., 2007).

Similarly, Skelton et al. (2005) conducted a randomized controlled trial to compare a fall management program (FaME) to a control group. The FaME program addressed balance, strength, endurance, flexibility, gait and functional skills, as well as “righting” or “correcting” skills to avoid a fall. Women, ages 65 and older who had experienced three or more falls in the previous year, participated in 36 weeks of either the FaME intervention group, or a control group consisting of simple home exercises such as a seated warm-up, mobility, flexibility and cool-down exercises. Women who participated in the FaME program fell significantly less compared to the control group who engaged in simple home exercise programs. Women in the FaME program were also less likely to be hospitalized, enter a nursing home, or die (Skelton et al., 2005). This study supports the idea that structured exercise programs are more effective than simple home exercises in addressing intrinsic risk factors to avoid falls in individuals who have a history of falling.

Another study researched whether Stepping On, a community and group-based program, could reduce fall risk and improve fall efficacy. The Stepping On program targeted fall risk through improving balance and strength, environmental and behavioral safety, medication management, and encouraging visual health and adaptations for low vision (Clemson et al., 2004). Three hundred and ten community-dwelling men and women, over the age of 70 who had previously experienced a fall, participated in the program. The intervention group attended seven weeks of group sessions led by a trained occupational therapist. The group members learned, discussed, and practiced lower limb balance and strengthening exercises, strategies to cope with visual problems, how to manage medication, and how to navigate the environment and home safely. They also received a follow up home visit. The control group received two social visits from occupational therapy students in which fall and fall risk were not discussed. Results showed that the intervention group reduced falls by 31% (Clemson et al., 2004). Participants' fall efficacy, related to functional tasks that challenged posture, also improved (Clemson et al., 2004). This study demonstrates the value of multifaceted programs that emphasize balance and strengthening exercises as a means for fall prevention in previous fallers.

Another study conducted by Faber, Bosscher, Chin A Paw, & Wierirgenand (2006) aimed to determine whether exercise programs increased mobility and decreased fall risk in "frail" adults compared to "pre-frail" adults. Two hundred and seventy-eight male and female adults between the ages of 63 and 98, living in 15 long-term care centers, participated in the study. The participants were classified as "frail" if they reported three or more measures in unintentional weight loss, weakness, exhaustion, slowness, and low physical activity. The remaining participants were determined as "pre-frail" if only one or two of the measures were present. Participants then participated in two exercise programs: exercises related to functional mobility and walking, and a Tai Chi balance program. Measurements from the study included falls, Performance Oriented Mobility Assessment, physical performance score, and the Groningen Activity Restriction Scale (Faber et al., 2006).

Findings from the study showed that the exercise program significantly benefited older adults who were "pre-frail". On the other hand, after completing the intervention programs, the "frail" participants did not demonstrate improvements in reducing fall risk (Faber et al., 2006). This study challenges the idea that exercise programs are effective for all older adults, regardless of physical condition, and indicates that fall prevention exercise programs may be best suited for older adults before they become frail.

Exercise and Fall Efficacy

Fall efficacy refers to the measure of an individual's fear of falling, and a person's sense of control in avoiding a fall (AOTA, 2006). Having a low fall efficacy can result in depression and an increased risk of future falls, as fear of falling can reduce one's engagement in physical exercise and activity (Chou, Yeung, & Wong, 2005). Conversely, engaging in activities and exercises that increase stability, mobility, and confidence can increase fall efficacy in older adults who have either fallen or not fallen (Choi, et al., 2005; Hedley et al., 2010; Hess & Woollacott, 2005; Lach, 2005; Seo et al., 2012). Nonetheless, there is a lack in research to ascertain how exercise, particularly lifestyle-integrated exercise, affects fall efficacy.

Fallers. Although any older adult can develop a fear of falling, this fear is commonly triggered by a past fall (Boyd & Stevens, 2009; Lach, 2005). Lach (2005) examined the incidence and risk factors of fear of falling on older adults in a longitudinal study. Eight hundred and ninety community-dwelling older adults were interviewed four times about their experience with falls, balance, cognition, and their fear of falling. Lach (2005) found that participants who had fallen more than twice, or had experienced a fall that resulted in an injury, had a higher level of fear of falling. Results also showed that not only did having a previous fall increase fear of falling, but reciprocally fear of falling could increase risk of falls (Lach, 2005).

A low fall efficacy is often correlated with having decreased balance and mobility (Tiernan, Lysack, Neufeld, Goldberg, & Lichtenberg, 2014). Completing specific exercises that increase strength, balance, and ultimately confidence while ambulating can increase fall efficacy. Tiernan et al. (2014) conducted a study to measure how fall efficacy relates to other health issues. Four hundred and forty-nine men over the age of 55 completed a questionnaire that included fall history, mobility and self-regulated health. Participants also completed the Falls Efficacy Scale, a survey rating the level of confidence on a scale of 1-10 on certain activities of daily living. One quarter of the participants who had reported that they had fallen at least once within the previous year demonstrated a low fall-efficacy. Furthermore, participants who had fallen before and/or had low fall efficacy had more mobility problems and a difficult time walking long distances. These results showed that mobility and previous falls are correlated to fall efficacy (Tiernan et al., 2014).

The Staying Steady Program was a 32-week community-based exercise program for fall prevention targeted at older adults who were at risk of falling (Hedley et al., 2010). The study included five women, three of whom had recently experienced a fall. The population sample is a limitation to the study because there was a small number of participants and they were all women. The fall program consisted of various exercises including cardio, resistance, dynamic balance, and a cool down. This was paired with a home exercise program that included cardio, resistance, stretching, and balance. The researchers measured grip strength, the Timed-Sit-to-Stand assessment, as well as gait and balance using the Performance-Oriented Assessment of Mobility (POAM) to further explore the participants' physical abilities. The researchers also implemented focus groups and individual interviews. Participants had an average of 80% adherence rate to the program and all the participants greatly improved in their gait and balance, sit-to-stand time, hand grip, and measures of self-efficacy (Hedley et al., 2010). This study suggests that specific exercise programs can improve fall efficacy in older adults who have fallen. However, although the study employed valid balance and gait assessments for predicting fall risk, only two assessments were used. Therefore, the limited number of assessments may not have provided enough information about participants' fall risk. In addition, the authors also attributed socialization throughout the program to having an effect on the participants' adherence. This research suggests that if social bonds are created within fall prevention program, these bonds can lead to a higher rate of adherence to the program (Hedley et al., 2010).

Hess and Woollacott (2005) conducted a study examining the effect of a ten-week high intensity strength training program for community-dwelling older adults who have decreased balance abilities. The participants were comprised of 27 men and women recruited from the Eugene, Oregon area. Thirteen older adults were placed in an experimental group, while the other 14 were placed in a control group (Hess & Woollacott, 2005). The criteria for a balance impairment included previously experiencing fall, the use of a walking aid, or an unsteady gait. Balance and strength were measured using the Timed Up and Go (TUG) test and the Berg Balance Scale (BBS), while fall efficacy was measured using the Activities-Specific Balance Confidence (ABC) scale. The experimental group met three days a week over the course of ten weeks, and used various exercise equipment. The equipment used consisted of a Hammerstrength tibia dorsiflexion machine, a Maxicam machine to engage the plantar flexor muscles, a Maxicam Variable-Resistance Machine that focuses on knee extension and knee flexion to engage the quadriceps and hamstrings (Hess & Woollacott, 2005). The participants performed three sets of eight repetitions in each exercise (Hess & Woollacott, 2005).

After the intervention, the experimental group's mean TUG score indicated a 30% decrease in fall risk, their mean BBS score increased by 2.4 points, and ABC score increased by 8%. The results showed that strength training exercise improved the experimental groups' general self-efficacy in everyday activities, particularly during exercise. This means that the participants felt especially more confident in their ability to not fall when they were exercising. Their increased scores indicated that high-intensity strength training may be effective in increasing a person's balance, strength, and balance confidence (Hess & Woollacott, 2005).

Seo, Kim, and Singh (2012) conducted a single blinded, controlled trial with a pretest posttest exercise assessment. The researchers explored various exercise interventions and the effects on fall efficacy. Participants included 95 women, over the age of 65, who had experienced a fall within the last year. Participants were divided into three groups: resistance training, balance training, and a control group. The resistance training group worked on increasing strength, while the balance training groups worked on balance, coordination, and proprioception. After the intervention, fall efficacy was measured using Tinetti's Fall Efficacy Scale (Korean version), which has high reliability and validity in measuring fall efficacy. Participants in both the resistance training and balance training groups showed significantly greater fall efficacy, compared to the control group. Levels of fall efficacy did not differ between the resistance and balance training groups (Seo et al., 2012). This study suggests that various forms of exercise programs targeting strength and balance can improve fall efficacy in fallers. In older adults, having high fall efficacy is correlated with a reduced number of falls. Engaging in exercises that increase balance may additionally increase confidence while ambulating and overall fall efficacy.

Non-Fallers. Because falls can be unpredictable, it is important to address factors that correlate with fall risk and fall efficacy in older adults who have not experienced a fall. There have been few, but effective, studies on exercise programs to increase fall efficacy for non-fallers (Choi et al., 2005; Hedley et al., 2010). Research has proven that exercise for older adults that focuses on lower extremity muscles can increase an individual's balance and strength, which can increase balance ability in both fallers and non-fallers (Choi, et al., 2005; Faber et al., 2006; Hedley et al., 2010; Hess & Woollacott, 2005; Skelton et al., 2005). Increased balance ability may then improve fall efficacy, and consequently decrease fall risk.

Other methods of exercise such as tai chi have also proven to increase fall-efficacy in both fallers and non-fallers. Tai chi is a slow-paced and low intensity exercise that improves "muscle strength, flexibility, mobility, balance with eyes open, and fall avoidance efficacy" (Choi, et al., 2005, p. 155). Choi et al. (2005) facilitated a 12-week Sun Style tai chi exercise program, with 29 experimental participants and 30 control participants. According to this study, a faller is considered a person who has fallen at least once in the past year. Within the experimental group there were 19 fallers and 10 non-fallers; 23 females, and 6 males. Within the control group there were 17 fallers and 13 non-fallers; 21 females and 9 males. The exercise sessions consisted of a 10-minute warm-up in which the participants greeted one another by shaking hands, followed by exercising two ranges of motion in the shoulder, neck, hip, knee, ankle, and trunk (Choi, et al., 2005). Next, the participants did 20 minutes of 12 tai chi movements that required the participants to "bend their knees in wide steps" (Choi, et al., 2005, p. 152).

Researchers measured balance, fall episode, muscle strength, and fall efficacy. Balance was measured by how long participants could stand on one leg with their eyes closed, fall episodes were reported weekly, muscle strength was measured using a manual muscle tester, and fall efficacy was determined using the Fall Efficacy Scale. The results showed that sun-style tai chi is effective in increasing lower extremity muscle mobility and strength for both older adult fallers and non-fallers. The experimental group's average Fall Efficacy Scale scores increased from 87.9 to 93.5 while the control group's average score decreased by 4.7 percent (Choi, et al., 2005). Thus, similar forms of low impact activities such as shifting one's weight from one leg to the other, and stepping over objects may also improve fall efficacy.

Compliance and Motivation to Exercise in Older Adults

Motivation and compliance are key factors to assess when creating an exercise program to ensure that the participants continue to benefit from the program. Both integrative and traditional fall prevention programs include exercises that address balance and strength. However, many adults that participate in traditional exercise programs have a difficult time maintaining their exercise regime upon completion of the program (Department of Human Services, 2007). In contrast, integrative exercise programs are an effective and convenient way to motivate older adults to stay active and adhere to the fall prevention exercise program. Research shows that incorporating mild to moderate exercise into daily life can reduce the risk of falls in older adults (Clemson, et al., 2012; Lord et al., 2005; Newson & Kemps, 2007).

Traditional forms of exercise. Fall risk prevention programs incorporating traditional exercises, such as balance and strength training can reduce the risk of falls. To reap the benefits from exercising, a fall prevention program should ensure that older adults are motivated to continue to exercise after completing the program. However, adherence to the program diminishes over time as many older adults become uninterested in the activities and exercise program. Furthermore, older adults may lack motivation to comply with the exercise program due to health status and inability to complete the exercises (Newson & Kemps, 2007).

Lord et al. (2005) conducted a randomized controlled trial that studied the effectiveness of a multifactorial fall prevention program that addressed improving fall risk factors such as strength and balance. Six hundred and twenty older adults 75 years or older participated in an individualized exercise program that was completed in a group setting. The exercise activities included seated resistance training; wall-squats, heel raises, and ball throw and catch. The goal of the exercises aimed to improve strength, flexibility, coordination, and balance to reduce the risk of falls. While the exercises demonstrated slight improvements in balance and strength, there were no improvements in fall reduction. Additionally, compliance to the program was poor to fair as many participants did not continue to follow through with the exercises upon completion of the group classes (Lord et al., 2005). Thus, the structure of these traditional exercise programs may not be motivating or sustainable to encourage the participants to continue after completing the program.

Although many older adults are aware of the benefits of regular exercise, compliance to a traditional exercise program may be low due to lack of interest in the activity, or health concerns about the intensity of the exercises (Newson & Kemps, 2007). A study conducted by Newson and Kemps (2007) examined the barriers and motivators to exercise that promote and prevent older adults' engagement in exercise programs. Two hundred and seventeen older adults between the ages of 63 and 86 living in Australia completed a structured set of questions. The survey included standardized questions targeting background characteristics, level of exercise, motivation to exercise, barriers to exercise, and intention to exercise in the future (Newson & Kemps, 2007).

Results indicated that the most common motivators to exercise were those related to increasing health and fitness. This finding supports that older adults are aware of the benefits of exercise. However, the most common barriers to exercise included medical problems, a lack of exercise facilities, and knowledge about exercises to partake in (Newson & Kemps, 2007). The results also demonstrated that older adults are most likely to engage in exercise programs that provide alternative opportunities to exercise, such as integrated exercise, as compared to traditional exercise.

Integrated exercise. In contrast to traditional exercise programs, integrative exercise programs can be effective in reducing the risk of falls by incorporating balance and strength training into daily activities (Clemson, et al., 2012; Opdenacker, et al., 2008). One advantage to integrative lifestyle programs is that people learn to incorporate exercise into their daily lives, making it easier to maintain activity upon completion of the program (Opdenacker, et al., 2008).

Another advantage to the lifestyle programs is that the exercises are meaningful and may keep older adults interested and motivated in the activities.

Opdenacker et al. (2008) compared the long-term effectiveness of a lifestyle intervention program to a structured exercise intervention program in older adults. One hundred and twenty participants over the age of 60 were randomly assigned to a lifestyle intervention, a structured exercise group, or a control group consisting of a program for fitness and health status check-up. The 24-week long structured exercise program consisted of three weekly sessions of 60-90 minutes of supervised endurance, strength, flexibility, and balance training. Participants in the lifestyle intervention group were taught how to integrate exercise into daily routines while using a pedometer and checking their heart rate. Activities such as walking, jogging, cycling, swimming and strength training, using bodyweight exercises, were included in the program. Additionally, the program was individualized based on the individual's interests and abilities. Participants were also encouraged to either walk or ride a bike instead of driving as a means for transportation. Researchers measured physical activity using self-report questionnaires, pedometers, and accelerometers before the study, at the end of the study, and 23-months after completion of the study. Results indicated that both intervention groups increased the amount of physical activity compared to the control group. However, one year after the program, the structured group no longer demonstrated compliance to participation in physical activity and exercise. In contrast, the lifestyle group maintained a significant increase in physical activity in daily routines, including active transportation (Opdenacker, et al., 2008). This study indicates that integrative exercise programs can be more effective in long term compliance to physical activity in older adults.

Lifestyle-integrated functional exercise. Clemson et al. (2012) developed The Lifestyle-integrated Functional Exercise (LiFE) program to assess if integrating balance and strengthening activities into daily routines could reduce the rate of falls in older adults. Older adults, ages 70 or older, who had experienced two or more falls, or one injurious fall within the previous 12 months, participated in the study. Participants were assigned to a structured exercise intervention group, the LiFE intervention group, or a control group consisting of 12 gentle flexibility exercises. Both intervention groups participated in five weekly sessions with two additional boosters sessions and two phone calls that spanned across a six-month period. The control group received three home visits and six phone calls. Participants assigned to the structured exercise intervention group engaged in a set of prescribed balance and lower limb strengthening exercises to be done at regular intervals three times per week. Participants assigned to the LiFE intervention group learned principles of balance and strengthening exercises that could be tailored to meet individual needs, and incorporated into daily activities (Clemson et al., 2012).

Participants in the LiFE intervention learned balance strategies such as "reducing the base of support", "move to limits of sway", "shift weight from foot to foot", "step over objects", and "turning and changing direction". They also learned strengthening principles such as "bend your knees", "on your toes", "up the stairs", "on your heels", "sit to stand", "walk sideways", and "tighten muscles" (Clemson et al., 2012). Participants were encouraged to incorporate the balance and strengthening principles into their everyday activities multiple times per day, as opportunities arose.

After a 12-month follow up, results showed that older adults who participated in the LiFE intervention group experienced a 31% reduction in the rate of falls, in comparison to the control group. There was no significant reduction in fall rates among participants in the structured exercise intervention. Compared to the control group, participants in the LiFE program also improved significantly in static and dynamic balance measures and functional outcomes, such as activities of daily living measures, and physical activity. Furthermore, participants in the control and LiFE program demonstrated significantly better adherence to the program compared to the structured exercise program (Clemson et al., 2012). This study proposes that balance and strengthening exercises that are incorporated into daily activities can be an effective and meaningful intervention to reduce fall risk in older adults who have previously experienced a fall. However, this study does not examine whether the LIFE program is effective in older adults who have not previously experienced a fall, and whether the program can increase an individual's fall efficacy.

The current research study evaluated the effectiveness of a modified LiFE program for older adults in an independent assisted living facility in Northern California. The study aimed to compare the effectiveness of the LiFE program between fallers and those who have not experienced a fall.

Fall Risk Assessments

A variety of fall risk assessments, including balance and fall efficacy assessments, are available for para-professionals including occupational therapy. Fall risk assessments enable practitioners to test and analyze an individual's balance capabilities, while also aiding the practitioner in determining the individual's risk of falling (Sibley, Straus, Inness, Salbach, & Jagfal, 2011). Fall efficacy assessments, on the other hand, measure the individual's perceived self-confidence in not falling during meaningful everyday activities (Lajoie & Gallagher, 2004; Myers, Fletcher, Myers, & Sherk, 1998; Powell & Meyers, 1995). Hence, fall risk assessments are important because they can provide practitioners with an unbiased look into participants' walking and balance ability, while also measuring their confidence in engaging in everyday activities.

Lower extremity strength and balance assessments. There are numerous assessments to measure lower extremity strength and balance. The literature features the Timed Up and Go-Manual test (TUG-manual), Functional Reach test (FRT), Tinetti Balance Scale (TBS), One-Leg Stand Test (OLST), the Berg Balance Scale (BBS), and The Chair-stand Test (CST) (Lin et al., 2004; Sibley et al., 2011). For the purpose of this study the researchers implemented the FRT, the TUG-manual, the OLST, and the CST. These particular assessments are appropriate for older adults and assess common movements older adults may perform in everyday life, such as standing from a seated position, leaning forward when reaching for items, and carrying items while walking.

Functional reach. The Functional Reach Test is used to identify fall risk based on how far individuals can reach. This test is appropriate as reaching is a necessary movement for independent living. The FRT's predictive validity was validated with 217 community-dwelling male veterans that were at least 70 years old from the Durham VA Medical Center (Duncan, Studenski, Chandler, Prescott, 1992). Participants who experienced two falls within six months were labeled recurrent fallers, while participants who experienced one or no falls were labeled non-fallers. The results showed that the low-functioning high-risk group had an average reach of 7.4 inches, while the high-functioning, low risk group had an average reach of 12.14 inches. Being able to only reach a short distance, or not reach at all, is indicative of a high fall risk (Duncan et al., 1992). This study asserted that using a cutoff score of 10 inches is a valid score to discriminate between fallers and non-fallers in community-dwelling older adults. The ability to reach more than 10 inches indicates one is unlikely to fall, reaching 6-10 inches indicates one is twice as likely to fall, reaching 1-6 inches indicates that the chance of falling is quadrupled, lastly, unable to reach indicates one is 28 times more likely to fall (Duncan et al., 1992).

Research performed by Lin et al., (2004) in Taiwan, compared the TUG, OLST, FRT and TBS in 1,200 community-dwelling older adults aged 65 and older. The results showed that those who had a high fall risk used a walking aid, were older, had experienced a fall in the past year, and had a difficult time performing activities of daily living, were only able to reach a short distance on the FRT and/or did not participate in the FRT or the other assessments (Lin et al., 2004). A short reaching distance was also indicative of a poor response to falling (Lin et al., 2004). Though the study utilizes a large sample with better chance of generalization, the study is limiting because the it was done in a different country with different cultural influences.

A study by Langhammer and Lindmark (2007) compared the performance of 19 institutionalized geriatric patients and twenty-six healthy older adults in the FRT. The researchers found that the FRT has a good interrater reliability and test-rest reliability with intraclass correlation coefficient scores of .92. This means that this assessment can be administered by different researchers and still obtain similar results. The researchers also discovered that the FRT has a construct-cross sectional validity score of r=.71 (Langhammer & Lindmark, 2007). Furthermore, the literature showed that healthy older adults were able to reach further on the FRT than institutionalized older adults (Langhammer & Lindmark, 2007).The downfall of Langhammer and Lindmark's study is that they only used a total convenience sample of forty-five participants.

Murphy, Olson, Protas, and Overby (2003) conducted a study to screen falls in fifty community-dwelling older adults recruited from a senior center. The participants included 13 men and 37 women, with an average age of 72.3. The results revealed that over a 14-month span, 34 participants did not experience a fall, while 16 did. The researchers also asserted that the FRT has a sensitivity rate of determining a faller 73% of the time, and a specificity rate of determining a non-faller 88% of the time (Murphy et. al, 2003). These rates are good in their predictive ability of discriminating between fallers and non-fallers in community-dwelling older adults and therefore demonstrated that the FRT is a valid measure in detecting fall risk. Similarly, Lin et al. (2004) asserted that the FRT is suitable for healthy older adults, making it an appropriate choice for our study.

Timed up and go. The Timed Up and Go Manual Test assesses an individual's functional mobility. The TUG-manual allows the administrator to observe how a participant walks and his or her ability to maintain balance while walking and carrying a cup of water (Shumway-cook et al., 2000). The longer amount of time it takes for an older adult to complete the task correlates with an increased risk of falling (Shumway-cook et al., 2000). The TUG-manual test is considered appropriate for community dwelling older adults, as well as those who are weak, frail, or utilize walking aids (Lin et al., 2004; Podsiadlo & Richardson, 1991).

Lin et al.'s (2004) research showed that compared to the OLST, the FRT, and the Tinetti Balance test, the Timed Up and Go (TUG) test has the highest area under the curve (AUC) in its validity of predicting a fall (Lin et al., 2004). The AUC measures quantitative validity and enables researchers to determine the best measuring tool (Portney & Watkins, 2009). The researchers also found that participants were more willing to perform the TUG than the OLST and FRT (Lin et al., 2004).

Shumway-Cook, Brauer, and Woollacott (2000) conducted a study to compare the specificity and sensitivity of the TUG, TUG-manual, and Timed Up and Go Cognitive test

(TUG-cognitive). The study included 15 older community-dwelling older adults who had fallen at least twice in the past six months, and 15 who had not experienced a fall. The results showed that for participants who completed the assessment with 14.5 seconds or higher, the TUG-manual was able to predict a fall 90% of the time. Furthermore, the TUG-manual has a specificity rate of determining an individual who is not a faller 93.3% of the time and has a sensitivity rate in correctly determining an individual who is a faller 86.7% of the time (Shumway-cook et al., 2000). Shumway-cook et al. (2000) also showed that the TUG-manual has a high interrater-reliability rate of .99. Moreover, the researchers found that administering the TUG-manual test with another task did not make it more sensitive in identifying fallers, though it was discovered that a "secondary task had deleterious effect on functional mobility" (Shumway-cook et al., 2000, p. 902). Therefore, the TUG-manual can help to indicate if a person is more likely to fall during commonly-performed activities such as walking while carrying an object.

One-leg stand test. The OLST assesses static balance, by requiring participants to stand on each leg, one at a time. Research shows that the OLST is applicable for healthy older adults (Lin et al., 2004). Lin et al. (2004) found that the discriminant ability of the OLST, with regards to experiencing a fall in the past year, is .64 and the odd ratio using the OLST to predict the occurrence of falls over a one-year follow-up period is .99 (Lin et al., 2004). Therefore the OLST has a moderately-high predictive ability in determining if one has experienced a fall in the past, but a low predictive ability in determining if an individual will fall in the future. Nevertheless, the researchers noted that a longer standing time is indicative of increased balance ability (Lin et al., 2004). Lin et al. (2004) found that a short stand time for the OLST was effective in predicting a decline in ADLs, however it did not significantly predict the occurrence of falls or improvement in ADLs.

Springer, Marin, Cyhan, Roberts, and Gill (2007) performed a study to determine normative values for the OLST with 549 women and men between the ages of 18 and 99 years old. Normative values provide a standard for comparison to assess balance capability. The researchers found that OLST performance is dependent on age, as stand time decreases with age. This proves that static balance ability may decline over the lifespan. Springer et al. asserted that for healthy older adults ages 80-99, the OLST normative values for females is 10.6 seconds, and 8.7 seconds for males (2007). Furthermore, the results showed that when using an intraclass correlation coefficient, the OLST had an inter-rater reliability of .99 (Springer et al., 2007).

Franchignoni, Tesio, Martino, and Ricupero (1998) conducted a study to discover the reliability of four balance tests, including the OLST. The study's participants included 45 healthy older women ages 55-71 years old who lived at home and were able to walk independently without an assistive device. Furthermore, by using an intraclass correlation coefficient, the study found that the OLST has a moderate test-retest reliability scores of .76-.77 (Franchignoni et. al, 1998). In conclusion, the OLST is an appropriate measure for this study because it directly pertains to one's ability to safely maintain balance on each leg, which is one of the essential elements in the LiFE home program.

Chair-stand test. The CST measures lower body strength and fitness. The CST is one of the tests found in Rikli and Jones' *Senior Fitness Test Kit*. The assessments included in the *Senior Fitness Test Kit* were chosen because they have minimal ceiling and floor effects (Rikli & Jones, 2001). Normative data for the CST was gathered during an 18-month period during 1997 and 1998. The study included 7,183 participants, 5,048 women and 2,135 men aged 60 to 94 from 267 test sites and 21 different states. This large and diverse population makes this study a valid and representative measure of chair-stand norms in older adults. Participants in the study were typically physically active older adults who lived independently in the community, had no debilitating health conditions, and were able to walk without an assistive device (Rikli & Jones, 2001). Rikli and Jones (2001) asserted that the CST assesses lower body strength, which is necessary for common activities such as standing up from a chair and walking. The researchers compared the CST with the one repetition maximum (RM) leg press protocol, which is the highest amount of weight a person can lift without fatiguing, and found that the CST has a moderate criterion validity of .78 for men and .71 for women. The test is "able to detect expected performance declines across each decade from the 60s-80s" (Rikli & Jones, 2001, p. 29). For older adult women between the ages of 85-89, the cutoff number of chair stands for the 50th percentile is 10 chair stands. For older adult males between the ages 80-84 and 85-89, the cutoff number of chair stands for the 50th percentile is 12 and 11 chair stands, respectively. Research showed that the CST has a moderately high test-retest reliability of .89, meaning that the test results are consistent 89% of the time, regardless of repetitive testing (Rikli & Jones, 2001).

Researchers at the La Trobe University of Australia examined the performance of the CST in a six-week exercise program with 82 older adults who were waiting for knee or hip replacement surgery (Gill & Mcburney, 2008). The results showed that the CST has a strong inter-rater reliability, ranging from .96-.99 and strong intra-rater reliability, ranging from .97-.99 (Gill & Mcburney, 2008). Cho, Bok, and Hwang (2012) used the CST to evaluate the relationship between lower body strength, falls, and balance in 88 community-dwelling older adults. The sample contained 31 fallers and 55 non-falling older adults above the age of 65. The researchers found that fallers received lower CST scores than non-falling participants. Using a cut-off value of 15 sit-to-stands, the CST had a sensitivity rate of 61.8% and a specificity rate of 83.9% (Cho et al., 2012). Though the sensitivity rate is low, the specificity rate is high, which means that the CST is able to correctly determine if an individual is a faller 83.9% of the time. Therefore, the CST is a valid measure in discriminating between fallers and non-fallers.

Lower body strength and fitness, balance, vision, and the ability to know where one is in space, are necessary components to complete the CST (Shubert, Schrodt, Mercer, Whitehead, & Giuliani, 2006). These components are also necessary for walking safely and maintaining balance to prevent a fall. Thus, below average scores on the CST are correlated with an increased fall risk (Cho et al., 2012).

Other fall assessments. The POAM, otherwise known as the Tinetti Balance and Mobility assessment, is widely used and has several variations (Lin et. al., 2004; Raiche, Hebert, Prince, & Corriveau, 2000). The POAM consists of different measures that evaluate balance and gait. Lin et. al's (2004) study utilized the Tinetti Balance Measure (TBM), a 13-item tool that observes sitting and standing static and dynamic balances. Results showed that the TBM had the highest AUC for predicting a decline in activities of daily living (ADLs). However the results also showed that the Tinetti Balance and Gait test has a low discriminant ability of predicting fall risk of 67% (Lin et al., 2004).

Another variation of the Tinetti assessments is the Tinetti Balance Scale (TBS). Raiche, Herbert, Prince, and Corriveau (2000) conducted a study to test the validity of the TBS in 225 community-dwelling older adults aged 75 years and older. A cutoff score of 33 is found to have a 51% sensitivity and a 74% specificity; the cutoff score of 36 had 70% sensitivity and 52% specificity in discriminating between fallers and non-fallers. However, research also showed that individuals who had high scores still experienced a fall, indicating that the Tinetti tests have a ceiling effect (Raiche et al., 2000).

Another commonly used balance assessment is the Berg Balance Scale (BBS). The BBS consists of 14 items related to everyday functional movement and observes static and dynamic balances. The BBS has a high degree of internal consistency with a rating of .96. It also has an inter and intraobserver reliability of .98, and .99 respectively (Sibley et al., 2011). Muir, Berg, Chesworth, and Speechley (2008) conducted a cohort study on 210 community-dwelling older adults. The research showed that the BBS was not reliable for predicting falls because it did not identify many fallers. The authors wrote that with a cutoff score of 45 or less, the BBS predicts only 25% of falls and 45% of multiple falls for community-dwelling older adults (Muir et al., 2008).

In conclusion, although the BBS, TBS and POAM are popular and useful assessments, they are not appropriate for this study. The TBS and POAM have a ceiling effect, and the predictability of the BBS is also low for community-dwelling older adults. Therefore, the TUG-manual, FRT, OLST, and CST tests were chosen as fall risk assessments in this study.

Fall efficacy assessments. There are various methods used to measure fall efficacy, which is an individual's perceived self-confidence in not falling during meaningful everyday activities (Powell & Meyers, 1995). Assessments such as the Activities-specific Balance Confidence Scale (ABC), and the Fall Efficacy Scale (FES) are two commonly used tools to measure fall efficacy. A high fall efficacy is desirable and indicates that individuals are confident that they will not fall while engaging in activities in their everyday life (Gopaul & Connelly, 2012).

The Activities-specific Balance Confidence Scale is a sixteen-item questionnaire that asks individuals to note their perceived percentage of self-confidence of not falling while completing meaningful activities in various scenarios (Powell & Meyers, 1995). The percentages range from zero percent, indicating no confidence, to one hundred percent, indicating complete confidence. The items provide a diverse and well-rounded look into one's sense of fall efficacy (Powell & Meyers, 1995). Some of the scenarios listed include walking up the stairs, getting into or out of a car, or walking in a crowded mall where people are rapidly walking past them (Powell & Meyers, 1995).

The Fall Efficacy Scale is a short and simple self-rated survey that assesses individuals' level of concern of falling while engaging in 10 daily physical activities such as taking a shower, preparing hot meals, and grooming tasks. The level of concern is measured on a ten-point scale from one, being very confident, and ten, being not confident at all (Powell & Myers, 1995). Powell and Myers (1995) considered the FES items to be general and broad and therefore the results may not be consistent among participants. Tinetti, Richman, and Powell (1990) (as cited in Gopaul & Connelly, 2012), found that the FES has a decent but low test-rest reliability in community-dwelling older adults, with a Pearson's score of .71.

Powell and Myers (1995) conducted a study comparing the ABC and the FES. The study observed 102 community-dwelling older adults age 65 and over. The group included 17 men and 43 women. Results showed that the ABC scale is a reliable tool, as evidenced by its strong internal consistency of .96 and strong test-retest reliability of .92, while the FES has a strong but lower internal consistency of .90 (Powell & Myers 1995). The authors also concluded that the ABC has a strong validity for "discriminating loss of balance confidence in more highly functioning older adults" (Hess & Woollacott, 2005, p. 584).

Hatch, Gill-body, and Portney (2003) conducted a study to explore the connection between a person's perceived level of fall efficacy and his or her balance abilities. The participants consisted of 50 community dwelling, faller and non-faller older adults, ages 65-95. The participants were recruited through senior centers and senior housing facilities in the Boston area. Balance and fall efficacy was measured using the TUG and BBS and the ABC scale. The results showed that the ABC scores were higher in individuals who had better balance scores in the TUG and the BBS. This reveals that the ABC scale scores may correlate with a person's balance ability, and therefore a person's fall risk (Hatch et. al, 2003).

Lajoie and Gallagher (2004) conducted a study in order to determine cutoff scores to be used in predicting falls in older adults. The study included 125 participants, 80 of which were non-fallers and 45 who had experienced a fall in the past year. The mean age of the participants was 75.5 years old. The results showed that when using a cut-off score of 67% for the ABC, it was able to predict if a person would experience a fall with 84.4% sensitivity and 87.5% specificity (Lajoie & Gallagher, 2004). Myers, Fletcher, Myers, and Sherk's (1998) research asserted that scoring below 50 on the ABC Scale indicates a low level of physical functioning, scoring between 50-80 indicates moderate physical functioning, and scoring higher than 80 indicates a high level of physical functioning.

While both the FES and the ABC are reliable and valid, the ABC scale measures more common and detailed activities, making it more appropriate and effective for determining fall risk in older adults. Skalko, Sauter, Burgess, and Loy (2013) asserted that the ABC scale is a more powerful tool in discriminating between participants with or without poor balance and mobility. For the purpose of this study, the ABC scale was used.

Patient reported outcomes measurement information system (PROMIS) assessments. A holistic approach to examine the components of fall risk includes not only balance and perceived confidence in activities, but also factors such as physical functioning and overall health and well-being. The global health and physical function assessments that stem from the Patient Reported Outcomes Measurement Information System (PROMIS®) allow practitioners to delve into pertinent information about an individual's physical health and well-being. The global health assessment is a 10-item questionnaire that asks participants to rate the quality or frequency of various occupations and report how capable they are in completing their everyday physical activities. The items ask participants to rate factors such as the amount of physical pain they experience, how they feel about the quality of their relationships, and how they would rate their quality of life. The physical function assessment is a forty-five question assessment that asks participants to rate how much their physical ability limits their participation in activities, and how difficult different activities are such as getting in and out of a car and climbing up five steps. The global health and physical function assessments are appropriate tools for this study as they allow the researchers to garner important information that is not within the domain of the ABC scale or balance assessments (National Institute of Health [NIH, 2015]).

The PROMIS website states that the PROMIS tests are valid, reliable, and inclusive. In 2004 and 2010, the PROMIS was explored in various research sites, and tested with numerous populations in order to be representative of the greater population. The PROMIS tests can be used with most people, regardless of literacy level, age, medical status, physical ability, and language (NIH, 2015). Therefore, the PROMIS is a valid measure regardless of disease and domains.

Summary

Falls and fall-related consequences are major concerns for older adults. Falls not only lead to physical and medical concerns, but they can also create a fear of falling and lower fall efficacy even for individuals who have not experienced a fall episode (Boyd & Stevens, 2009; Lach, 2005). Exercise programs for older adults that target balance and strength are an effective means to reduce fall risk and improve fall efficacy (Lin et al., 2007;Seoet al., 2012; Skelton et al., 2005). Research showed that integrated exercise programs, such as the LiFE program, are more effective than traditional exercise programs to reduce fall risks because they are rooted in meaningful daily activities (Clemson et al., 2012). By incorporating balance and strengthening exercises into everyday activities, integrated exercise programs are a motivating and accessible means to address intrinsic fall risks in older adults, regardless of whether they have experienced a fall or not.

Statement of Purpose

The LiFE program is effective in preventing falls and increasing fall efficacy in individuals who have previously fallen (Clemson et al., 2012). However, there is no current study that looks at whether LiFE can reduce the risk of falls in non-fallers as it does for fallers. Furthermore, there is no research to show that integrated exercise, such as LiFE, instead of traditional exercise programs, increases fall efficacy in non-fallers. The purpose of this study was to examine if the LiFE program is effective in reducing fall risk and increasing fall efficacy in community dwelling older adult fallers and non-fallers. The null hypothesis states that the LiFE program will have no effect on fall risk and fall efficacy for fallers and non-faller older adults.

The alternative hypothesis states that there will be an effect on fall risk and fall efficacy for both fallers and non-faller older adults after completion of the LiFE program.

Theoretical Framework

Model of Human Occupation

The theoretical framework guiding the development of this research study is the Model of Human Occupation (MOHO). Developed by Gary Kielhofner in 1980, MOHO explains occupational performance according to the interaction between an individual's volition, habituation, and performance capacity within the environment of the individual (Dunbar, 2007). Kielhofner defined volition as the motivation for the occupation, habituation as how the individual organizes occupations using routines and roles, and performance capacity as the physical and mental capabilities that is required of each occupation (Dunbar, 2007; Kielhofner, 2008). According to Dunbar (2007), MOHO explains how an individual participates in occupations and can help occupational therapists identify factors that inhibit successful participation in occupations.

Volition. Humans have a biological need to actively participate in meaningful occupations (Kielhofner, 2008). Volition is the motivation to engage in an activity, and is determined by a sense of competence, the level of interest, and the value placed on an activity (Dunbar, 2007). An individual is more likely to choose to engage in an activity that leads to a sense of accomplishment than an activity that might lead to failure. When determining to participate in an activity, an individual is going to participate based on past experience, interest, and his or her sense of capacity (Dunbar, 2007).

Habituation. Familiar roles and automatic patterns of behavior such as taking the same route to work, waking up at the same time every day, and performing daily grooming are all habits that individuals participate in. Habits are determined by the unique role, as well as the internalized role, of the individual such as a student, teacher, or parent (Dunbar, 2007). According to Kielhofner (2008), habituation is defined as an internalized readiness to participate in consistent patterns of behavior. Habituation shapes the occupations that each individual participates in, as well as the way that those activities are achieved (Kielhofner, 2008).

Performance capacity. The capacity to participate in occupations is determined by the status of each individual's physical and mental components as well as past experiences of participation in those activities (Dunbar, 2007). Performance capacity emphasizes the experience of the individual and its role in shaping how that individual chooses to do activities (Kielhofner, 2008). Furthermore, the subjective experience influences how an individual will perform and interact with his or her world (Dunbar, 2007).

Application of MOHO to the current research study. This study aims to identify whether LiFE, an integrative exercise program, will prevent falls, and increase fall efficacy among older adults who have not previously experienced a fall, in comparison to older adults who have previously experienced a fall. The LiFE program was developed to integrate balance and strengthening exercises into daily activities, which creates convenient opportunities to practice and integrate the exercises in a meaningful way. By integrating the exercises as a part of daily routines and activities, not only do balance and strengthening capacities improve, but the adherence and compliance to the exercise programs improve as well (Clemson et al., 2012).

Applying the concepts of MOHO, this study encourages participation in meaningful occupations through the interaction of volition, habituation, and personal capacity. Balance and strengthening activities will be tailored to meet each participant's daily routines and interests, incorporating these activities into his or her existing meaningful occupations. Furthermore, by engaging in the tailored strength and balance activities, older adults may prevent a future fall. Thus, the balance and strengthening activities implemented in this study are considered both meaningful occupations in themselves, as well as a means to maintain and enhance the participation in other personal meaningful occupations.

This study addresses volition by allowing the participants to plan and implement specific exercises that they feel competent and comfortable in doing. The LiFE program is tailored to meet the needs and attitudes of each individual participant. By integrating the balance and strengthening activities that the individual participant feels comfortable performing, volition towards the activities increases as the familiarity and comfort with the activities increases. Practice and successive mastery of the chosen activities improves efficacy, which then strengthens the desire to persist with the activity.

As volition towards each activity increases, the participants are motivated to engage in the activity more often, resulting in habituation. Habituation is the key component of the LiFE program. Because the program is tailored to each individual's needs and lifestyles, the LiFE program is structured to enhance adherence to the balance and strengthening activities by incorporating them into daily habits and routines. Planning using worksheets, situational and environmental cues, as well as practice and repetition, encourages habitual changes in the participants' daily routines (Clemson et. al, 2012). Furthermore, as the balance and strengthening activities are successfully integrated into their everyday lives, the older adults achieve a sense of efficacy in their newly formed habits. This efficacy then becomes an internal motivation to continue participating in the balance and strengthening activities.

This study also directly addresses performance capacity by improving the physical components of the participants. In order for individuals to engage in meaningful occupations, they must have the physical and mental abilities to meet the demands of the activity (Dunbar, 2007). By using occupation-based activities to improve balance, strength, and fall efficacy, this study can improve the performance capacities of the older adults. The LiFE program aims to prevent falls. By examining the interaction between volition, habituation, and performance capacity of the older adults, the LiFE program can better enhance occupational participation.

Social Cognitive Theory

In addition to MOHO, the Social Cognitive Theory (SCT) will also be used to guide this research study. The SCT was developed by Albert Bandura in the 1960s and assumes that learning occurs in a social context with a dynamic interaction between the person, environment, and behavior (Boston University School of Public Health [BUSPH], 2013). The unique aspect of the SCT implies that there is a social influence on an individual's behavior and how the behavior is performed (BUSPH, 2013). For example, an individual's past experiences will factor into whether or not a behavioral action will occur (BUSPH, 2013). Furthermore, those past experiences influence reinforcement, expectations, and self-efficacy which shape whether or not the individual will participate in a specific behavior, and why that behavior was acted on (BUSPH, 2013).

Application of SLT to the current research study. The LiFE program encourages the social context that is integral to the Social Cognitive Theory. The activities will be taught in a group setting through which participants can observe and model others. By meeting in a group context, the participants will have the opportunity to learn and exchange information about various ways to incorporate each new activity into their daily lives. The group discussion not only allows for modeling, but also motivates and promotes positive reinforcement of the activities through sharing successes among fellow participants.

Furthermore, the researchers will be guiding the participants through self-directed and individually tailored activities that they feel comfortable completing. By emphasizing activities of the LiFE program that are individualistic and meaningful to each older adult, the participants are more likely to engage in the activities routinely. As the participants successfully engage in the activities, their efficacy increases. Furthermore, by increasing efficacy towards the activities, the participants will be more motivated to continue to engage in them after completion of the program.

Definitions and Variables

Definitions

Occupations. "Daily life activities in which people engage. Occupations occur in context and are influenced by the interplay among client factors, performance skills, and performance patterns. Occupations occur over time; have purpose, meaning, and perceived utility to the client; and can be observed by others (e.g., preparing a meal) or be known only to the person involved (e.g., learning through reading a textbook)" (AOTA, 2014).

Activities of daily living (ADLs). "Activities oriented toward taking care of one's own body" (AOTA, 2014).

Fall efficacy. "Current level of confidence in performing activities without falling" (AOTA, 2006)

Variables

Independent variable. Modified LiFE program.

Dependent variable. Balance, strength, fall efficacy, and quality of life after completion of the program.

Ethical And Legal Considerations

The researchers obtained approval from the Dominican University of California Institutional Review Board for the Protection of Human Participants (IRBPHP #10307) (Appendix A). Researchers applied the occupational therapy code of ethics to guide them throughout the design and process of the research study. Problems that could have arisen in implementation were falls, injuries, psychological discomfort, bias, and confidentiality.

The researchers applied two principles of confidentiality throughout the study. The participant's data were confidential, as each participant was assigned with a code number that was used on all documents. Each participant's name and corresponding code number were kept on a password-protected computer. All data and information about the participants including assessment sheets, and home program log sheets, were transferred onto an Excel document and stored in locked, password protected computers with the researchers and faculty advisor Dr. Kitsum Li. The master code sheet was stored in one of the researchers locked computer and with the faculty advisor's locked office at Dominican University of California. All data and records will be destroyed after a period of one year following completion of the research project.

The researchers used non-maleficence, which includes preventing harm or injury to the participants. To minimize fall risk during the study, the researchers guarded each participant to protect him or her from falling. In order to minimize the risk of injury when performing the balance and strengthening activities, the researchers instructed proper positioning of balance and strengthening activities and ensured that the participants knew exactly how to do each activity safely before they tried it. The researchers modified the area, and decreased clutter, to assure a safe environment. Though the researchers could not modify the participants' homes, the researchers encouraged the participants to modify their homes in order to perform the activities safely. To minimize psychological discomfort, each participant was encouraged to complete the activities to their own comfort level, without regards to other participants' progress.

Researchers also demonstrated veracity throughout the study. In order to complete this research study, the researchers gained permission from the author of the LiFE Program from Dr. Clemson, to use the program and to make copies of the manual (Appendix B). Permission was also granted to use the Montreal Cognitive Assessment (MoCA) (Appendix C). The researchers continued to exhibit veracity throughout the course of the study by providing the participants with accurate and complete information.

Methodology

Design

This study was a modified replication of the original three-arm randomized parallel trial conducted by Clemson et al. (2012). The research design for this study was a one-group pre-test post-test experimental design. The original research study provided evidence that this exercise program can be successful in reducing fall risk for older adults who have experienced a fall. This study examined the effectiveness of a modified version of the original program with non-fallers. This program was modified in a number of ways. Firstly, the original study included only fallers, used a control group that participated in gentle exercises, a structured exercise group, and a LiFE group. All participants were followed for one year and their lower extremity strength and balance, balance self-efficacy, quality of life, and other factors were recorded. In addition, the original LiFE group had two booster sessions. The current study allowed for both fallers and non-fallers to participate, featured an experimental group that participated for only 6 months, and provided one face-to-face booster session and two booster phone calls. Moreover, the current study measured fall self-efficacy, fall risk, and balance ability.

Participants

The population for this study was English-speaking adults over the age of 65 who live in assisted and independent living facilities. There were no gender, racial or ethnic-based exclusions. Participants for the study may or may not have experienced a fall. For those individuals who were considered a faller, the fall must have occurred within the previous six months. The participants had to be able to walk independently, with or without the use of a cane. The inclusion criteria also required participants to have mild to no cognitive deficits, as shown by scoring a minimum of 18 out of 30 on the MoCA (Appendix D). All participants had to be able to provide their own consent to participate in the study and agree not to participate in other structured, group exercise program(s) during the 26-week study period. Participants were recruited through posted fliers (Appendix E), staff recommendations, and information sessions.

Intervention

Prior to the initiation of the LiFE program, an informed consent form (Appendix F) and bill of rights (Appendix G) were used to provide participants with an overview of the study. The consent form included a description of the purpose and background of the study, the procedures of the study, the potential risks and areas that may cause discomfort, and the potential benefits of the study. The participants then completed the screening and pre-test assessments. After completing the pretest, the participants met with the researchers as a group, for one-hour training sessions, once per week, for five weeks to learn the LiFE balance and strengthening activities. On the first meeting, participants received a copy of the Participants Manual, which included the Daily Routine Chart and instructions. The participants also received the Activity Planner (Appendix H-1, H-2) and Activity Counter (Appendix I) to monitor their implementation of the balance and strengthening activities into their daily activities. Participants were instructed to implement the balance and strengthening activities multiple times throughout the day, and in a variety of contexts. At session 5, participants received the Progress Chart to document the number of balance and strengthening activities they perform each week. After completion of the group program, the researchers administered the post-test during week seven. Three weeks later, the researchers administered a booster session to provide the participants with encouragement to continue and assist with problem solving to ensure optimum participation. For the next 12 weeks, the researchers provided the participants with two scripted booster phone calls (Appendix J) to ensure persistency of participation. Six weeks after the 2nd booster call, the researchers conducted a follow-up assessment session. In the follow-up assessment session, participants were encouraged to continue with their own progress to further habituate the balance and strengthening activities into daily routine. The participants continued the activity log until Week 26 of the program.

Table 1: Overview of the Modified LiFE Program (Modification Made from the Original Program from Clemson et. al, 2012)

Session and week number	Session Format	Time allocated
Pre-tests Week 0	Initial screenings and pretests. Provide the participants with the participant's manual, the Daily Routine Chart (DRC) and instructions on how to complete it.	1 hour
Session 1 Week 1	Evaluate the ability and opportunities for LiFE activities using the DRC. Introduce the LiFE Program and go through the participant's manual. Commence teaching the LiFE program-key points and balance and strengthening training principles. Teach and implement one to two balance and one to two strengthening activities linked to a specific daily task, situation or place. Plan how, when and where to embed the activities and record the plans using the Activity Planner. Plan Activities to be counted using the Activity Counter. Instruct participant in how to use the Activity Planner and Activity Counter.	1 hour
Session 2-5 Weeks 2-5	Continue teaching and implementing the LiFE program. Introduce and teach new activities--one to two balance and one to two strengthening activities each session, linking the activities to specific daily tasks, situations, or places. Increase the autonomy of participants in selecting opportunities to embed activities in daily tasks and in upgrading. Use the Activity Planner to record plans and upgrades. Use the Activity Counter to provide baselines and reinforcement. Teach strategies to make the program more effective. Provide the Progress Chart to document the number of	1 hour each

	balance and strengthening activities performed.	
Session 6 Week 6	Collect the Activity Counter and Activity Planner. Conduct Post-tests.	1 hour
Session 7 Week 9	Provide a face-to-face booster session to provide support and address any questions participants may have. Return the Activity Counter and Activity Planner. Instruct the participants to continue to use the Activity Planner and document their progress on the Progress Chart for the following 3 months.	20 minutes
Session 8 Weeks 14 and 21	Provide two booster phone calls to offer support, encouragement, and address problems if they are present.	5 to 10 minutes per person.
Session 9 Week 26 (12 weeks later)	Collect the Activity Planner and Progress Chart. Conduct Follow-up assessment.	1 hour

Data Collection Procedures

To screen in the participants, the researchers administered the MoCA to test for mild cognitive deficits. The researchers used standardized balance assessments to assess balance, and self-questionnaires to measure fall efficacy, overall general health, and physical ability. The fall risk assessments include the TUG-manual test, the CST, FRT, and the OLST (Appendix K). To assess fall efficacy, participants completed the ABC Scale (Appendix L), which asked the participants to rate their perceived self-confidence of not falling while completing meaningful activities in different situations. To assess general health and physical ability, the researchers used the global health (Appendix M) and physical function assessments (Appendix N) from the Patient Reported Outcomes Measurement Information System (PROMIS®). All of these assessments are in the public domain, with the exception of the MoCA. The researchers have obtained permission from the author of MoCA for use in this study.

Results

All included participants were community dwelling older adults that resided in assisted and independent living facilities. A total of 13 participants were recruited for the study. Two older adults from Martinelli House, and seven older adults from Nazareth House met the inclusion criteria and participated in the study. The ages of the participants ranged from 72 to 93. The mean age was 85 (*SD*=9). Out of the nine participants, only one had experienced a fall six months prior to the start of the study. All of the participants, except one, exercised regularly prior to the start of the program, which included walking a few times per week, balance training, physical therapy exercise, and full body aerobic exercise. The number of medications the participants took ranged from zero to eleven. By the third session, five participants withdrew from the program. Three participants withdrew for medical reasons and two did not wish to continue with the program for personal reasons. Therefore, two females and two males (mean age = 85, *SD* = 2) continued with the study. All four participants who remained in the study walked independently without an assistive device. During the follow up assessment, one participant reported that she had begun physical therapy, therefore her assessment data were excluded from the final analysis. None of the participants experienced a fall during the 6-month study period.

The researchers compared the individual's pretest, posttest, and follow up scores for TUG-manual and FRT (table 2), CST (table 3) and OLST (table 4), and ABC scale (table 5).

Table 2: Fall Risk Assessment Data

Participant	FRT (Pre-test)	FRT (Post-test)	FRT (Follow up)	TUG (Pre-test)	TUG (Post-test)	TUG (Follow up)
A	11.5	9.83	8.5	12.79	12.94	11.04
B	16.3	16.3	13	14	13	15
C	9	12.8	10.6	18.26	11.1	13.57
D	18.5	10	10	12	15	15

Note: FRT values were measured in inches; TUG values were measured in seconds

Table 3: Balance Assessment (CST) Data

Participant	Pre-test	Post-test	Follow-up
A	6	9	10
B	9	10	9
C	12	12	12
D	10	11	11

Note: CST values were measured by number of completed sit-to-stands in one minute

Table 4: Lower Extremity Assessment (OLST) Data

Participant	Left leg (Pre-test)	Left leg (Post-test)	Left leg (Follow-up)	Right leg (Pre-test)	Right leg (Post-test)	Right leg (Follow-up)
A	3	5	17	1	3.35	4.8
B	19	24	45	7	30	15
C	5.12	3.12	18.44	7.36	19	5.94
D	2	1.44	1.47	1	1.32	1.31

Note: OLST values were measured in seconds

Table 5: Fall Efficacy Assessment (ABC) Data

Participant	Pre-test	Post-test	Follow-up
A	76.66	76.875	81.25
B	96.88	93.75	93.75
C	73.13	70	85.62
D	95.63	91.88	95.63

Note: ABC values were measured by self-report on the ABC scale

Data Analysis

Fall Risk Assessments

In this study, the FRT and TUG-manual were used to assess fall risk. While the FRT measures static balance, the TUG-manual measures dynamic balance. According to the FRT, the inability to reach more than 10 inches, using a stable base of support, is indicative of a fall risk (Duncan, Studenski, Chandler & Prescott, 1992). Based on this cutoff value, one of the participants (participant A) went from being not at risk for a fall to being at risk for a fall, while two participants remained not at a risk for falls (Table 6). On the other hand, a cutoff point of 14.5 seconds was used to determine fall risk in the TUG- manual assessment (Shumway-cook et al., 2000). The finding also showed that one participant (participant D) changed from being not at risk for falls to being at risk for falls, while the other two participants remained not at risk for falls. Therefore, based on the results from the FRT and the TUG-Manual, two of the participants showed a change in either static or dynamic balances and therefore, changes in their fall risk.

Balance Assessment

According to the literature, even though the OLST can be used to measure fall risk, it has a low predictive validity (Lin et al., 2004). Therefore, the OLST is used in this study to measure static balance skill. According to Springer, et al. (2007), the normative value for women ages 80-99 is 10.6 seconds; the normative value for men ages 80-99 is 8.7 seconds. Hence, after comparing the participants' performance in either the right or the left leg against the age-matched norm values, all but one participant (participant B) had minimal change in balance after participating in the LiFE program (Table 7).

Lower Extremity Strength Assessments

In this study, the CST was used to assess lower extremity strength. According to the literature, the CST is found to be an effective measure of lower extremity strength based on the number of times one can sit and stand from a chair in 30 seconds. Using the age-matched norm values from Rikli & Jones (2001), one of the participants increased her number of chair stands, and therefore her lower extremity strength, from the 15th to the 50th percentile from pre-test to follow-up. The second participant remained at the same lower extremity strength at the 35th percentile, while the third participant increased lower extremity strength from the 30th to 40th percentile from pre-test to follow up. Based on these results, participants either maintained or improved lower extremity strength (Table 8).

Fall Efficacy Assessment

The literature demonstrates that older adults' fall efficacy and level of physical functioning can be determined through the use of the ABC scale assessment. According to the literature, a score of 67% or lower also indicates a low fall efficacy and a risk for falls, and 50% or lower indicates low physical functioning (Lajoie & Gallagher, 2004; Myers et al., 1998). In this study, all participants began with a moderate or high level of physical functioning and fall efficacy based on the ABC scale scores. The results of the ABC scale showed that two participants maintained a high level of physical functioning, while the third participant increased from a moderate level to a high level of physical functioning after completing the program. Therefore, all participants scored above the cutoff point for being at risk for falls and were not considered at fall risk when measured by the ABC scale.

Table 6: Fall Risk Analysis

Participant	*FRT (Pre)*	*FRT (Post)*	*FRT (FU)*	*TUG-manual (Pre)*	*TUG-manual (Post)*	*TUG- Manual (FU)*
A	*No*	*Yes*	*Yes*	*No*	*No*	*No*
B	*No*	*No*	*No*	*No*	*No*	*No*
D	*No*	*No*	*No*	*No*	*Yes*	*Yes*

Note: No = Not at risk for fall; Yes = At risk for fall. Pre = Pre-test; Post = Post-test; FU = Follow up

Table 7: Balance Test Using OLST

Participant	*OLST Lt leg (Pre)*	*OLST Lt leg (Post)*	*OLST Lt leg (FU)*	*OLST Rt leg (Pre)*	*OLST Rt leg (Post)*	*OLST Rt leg (FU)*
A	*Below*	*Below*	*Above*	*Below*	*Below*	*Below*
B	*Above*	*Above*	*Above*	*Below*	*Above*	*Above*
D	*Below*	*Below*	*Below*	*Below*	*Below*	*Below*

Note: The length in seconds that the participant was able to stand with one-leg is compared with age-matched norm value (Springer et al., 2007). Above = Above age-matched norm; Below = Below age-matched norm. Lt = Left; Rt = Right; Pre = Pre-test; Post = Post-test; FU = 6-month follow up

Table 8: Lower Extremity Strength Using CST

Participant	*CST (Pre)*	*CST (Post)*	*CST (FU)*
A	*15th*	*40th*	*50th*
B	*35th*	*40th*	*35th*
D	*30th*	*40th*	*40th*

Note: The total number of chair-stand the participant was able to complete in 30 seconds is compared with age-matched norm in percentile (Rikli& Jones, 1999). Pre = Pre-test; Post = Post-test; FU = 6-month follow up

Discussion

The purpose of this study was to determine if LiFE is as effective in decreasing fall risk in non-fallers as it is with fallers. None of the three remaining participants was a faller, as defined by having a fall six months prior to the beginning of the study. While Clemson et al. (2012), demonstrated an effectiveness of the LiFE program with older adults who had experienced a fall, the current study was unable to conclude the effectiveness of the LiFE program for non-fallers. The second purpose of this study was to determine if the LiFE program is effective in increasing fall efficacy. Based on the ABC scores, all participants began the program with high fall efficacy and low fall risk, and maintained at the same level upon completion of the program. However, the researchers were unable to determine if the changes in fall efficacy were due to participation in the LiFE program due to the small sample size.

Three of the participants completed the 5-week program at Nazareth house while one participant from Martinelli House worked with the researchers separately on the Dominican University of California campus due to a scheduling conflict. Session five for the participants at the Nazareth House was postponed and rescheduled for the following week due to a holiday, similarly the single participant from Martinelli House had to re-schedule session four of the program due to personal reasons. Therefore, the program was prolonged from a 5-week program to a 6-week program for all participants.

During the training sessions of the program, the participants demonstrated their understanding of the balance and strengthening activities that they were expected to integrate into their daily lives, and recorded their activities at home independently. At the end of the program, four participants remained, however only three participants' data were analyzed due to one participant who began physical therapy shortly before the follow up assessment. In addition, the results of the PROMIS Global Health and Physical Functioning assessments could not be analyzed as the assessment forms were not suited for the study's participants. The activity counters from the remaining three participants showed that they remained consistent with their participation in the program throughout the study and on their own for the 16-weeks between the booster session and the follow up session.

Upon analyzing the data, the results were inconsistent between the FRT and TUG-manual. While both were used to assess fall risk, the assessments tested different constructs of balance and fall risk; the FRT measures static balance and the TUG-Manual measures dynamic balance. This may explain why the two participants had changes in their fall risk status in one assessment, but not in the other. Furthermore, even though the FRT was found to have a high inter-rater reliability, there may have been inconsistencies among the researchers while administering the assessment. This may explain the inconsistencies of the FRT scores as each researcher may have administered the assessment with different starting position requirements from the participants. For example, one researcher may have had participants begin the assessment standing with legs farther apart, which would have created a wider base of support for them to maintain better balance. Additionally, one researcher may have had participants begin the assessment with their shoulder already in protraction, which would cause variations in reaching distance. Additionally, inconsistencies in the FRT may be a result of the participants' increased awareness of falls while completing the LiFE program. This awareness may have impacted the FRT scores as the participants possibly were less willing to challenge balance and reach farther.

In addition to the inconsistencies in the FRT and TUG-manual, the results from the ABC scale were not consistent with those from the CST and OLST. The ABC scale is also an indicator of level of physical functioning. Therefore it can be assumed that a moderate or high level of physical functioning may imply better lower extremity strength and balance. While the participants rated themselves as having a moderate or high level of physical functioning on the ABC scale, their results on the CST were below the norms and their results on OLST were less than 50th percentile as compared with age-matched normative values. Additionally, some of the participants had participated in group exercise programs that involved seated activities prior to the start of the study. Participation in these programs may have impacted their self-rating physical functioning scores, however, this was not reflected in a higher level of balance and lower extremity strength when compared with age-matched norms.

The ABC scale can also be used to measure fall risk. According to the participants' scores on the ABC, none of the participants were at risk for a fall throughout the program. However, these scores were inconsistent with the fall risk assessments, FRT and TUG-Manual scores, which indicated that two participants were at risk for a fall, despite their high ABC scores. Since none of the participants had previously experienced a fall, they may have had a higher fall efficacy due to lack of concern about falls and fall related consequences. Thus, they reported moderate to high pre-test ABC scores prior to the start of the program.

It is also important to state that both the CST and OLST are similar to two of the exercises that were taught in the LiFE program. Thus, training effects of the LiFE program may have impacted the OLST and CST results and therefore may have been less sensitive as measures of balance and lower extremity strength.

Testimonials

Testimonials from all participants were also obtained from the booster session and follow-up phone calls (Table 9). The participants' recorded testimonials were examined to determine their opinions about the LiFE program. Upon collecting the testimonials, a Hawthorne effect was observed as the participants reported that they were eager to help the researchers with the study. Furthermore, it is not clear whether the participants would continue with the functional exercises upon completion of the program. In an attempt to help with habit formation, the activity counter was provided for participants to log balance and strength activities. However, the participants reported the logging process to be tedious and time consuming. It is also difficult to conclude if the participants have successfully integrated the LiFE program into their daily routines and habits, or if they were completing the exercises because they were required to record them in an activity counter. These reports also suggest that perhaps a different tool may be necessary to facilitate formation of habits with the integrated exercises into their daily routines. However, it is important to note that participants also reported lifestyle integration that may have demonstrated successful integration of functional exercises to daily routines (Table 9).

Table 9: Participant Testimonials

Lifestyle Integration	"I keep stepping over things when I water plants" "I make a point of going up and down steps" "What worked is doing these exercises in concert with other activities" "Took a long time to do it. I'm glad I did it. Sometimes I walk on my toes or heels. I try to do 22 or 23"
Change in Habit and Awareness	"I'm being more active. I'm doing a lot of exercises" "I'm more mindful about doing things" "[It] made us more conscious of things to do to stay in shape" "It was beneficial, hopefully I can continue to do that in the future" "I enjoyed doing it better than other exercise...I've been an exerciser for a long time"

Limitations

This study aimed to examine if the LiFE program is as effective in reducing fall risk and increasing fall efficacy for non-fallers as it is for fallers. An underlying limitation throughout the study was the small sample size (N=4), and only three participants' data could be analyzed. Since participation in this study required the older adults to stop participating in their regular, structured exercise groups, many potential participants during the recruitment period chose not to join the study because they preferred to remain in their existing exercise programs. Other participants dropped from the program due to medical reasons, such as surgery and recovery, or personal reasons, such as interest in rejoining their previous exercise groups. Due to the small sample size, the results remain inconclusive. Furthermore, one participant's data could not be used because the participant began physical therapy during the final weeks of the program, which created an extraneous variable.

In addition to the limitations of a small sample size, given that the ABC scale is a self-report assessment, it may not be reflective of actual fall efficacy in non-fallers. According to the ABC, all participants began with either a moderate or high level of physical functioning and fall efficacy, with all participants continuing to report high levels of physical function and fall efficacy during the follow up test. Because none of the participants had a history of falling, the initial moderate and high ABC scores may have been attributed to a lack of concern over falls and fall related consequences. High scores may have also been attributed to the self-reporting in the ABC assessment. All self-report assessments have inherent subjective bias.

In addition, a strong Hawthorne effect was observed. Participants reported doing the exercises for the sake of the researchers. These reports make it difficult to determine whether the participants formed habits that will continue after the program ended, and whether the amount of activities they completed throughout the weeks was driven by personal motivation to decrease in fall risk versus motivation to please the researchers. Similarly, the participants were required to plan and document the context and frequency they were completing each activity using the activity counter. The initial purpose of the activity planner was to help reinforce habits of integrating strengthening and balance activities into daily routines. However, by requiring the participants to use the activity counter, the researchers were unable to determine whether the participants completed higher frequencies of activities due to formation of habits, or if it was because they felt they were obligated to document. Furthermore, it is unclear how accurately and diligently each participant logged the exercises on the form. Therefore, documenting the amount of integrated activities they performed with the activity counter may not have been a practical way to measure their activity and promote sustainable habit formation. Additionally, the participants commented that the logging routine was tedious and time-consuming. The activity counter also presented a problem for one participant who did not understand how to document correctly. This led to inconsistency with how the results were reported by each participant.

In conclusion, although this study yielded inconclusive results, it may still have implications that the LiFE program could be beneficial to non-falling community-dwelling older adults in maintaining physical functioning level. More studies should be conducted to investigate the effectiveness of the LiFE program for community dwelling older adults, fallers and non-fallers, in reducing fall risk and improving fall efficacy. Future studies should also partner with more facilities in order to recruit a larger sample size. Clear expectations about documentation should be established and demonstrated by the participants to yield consistent data.

Conclusion

Falls and fall-related consequences are major concerns for older adults. One out of every three older adults over the age of 65 fall each year, resulting in an increase in health care costs spent on fall related injuries (CDC, 2009). Fall exercise programs that incorporate balance and strengthening are effective in reducing the risk of falls in older adults. However, traditional exercise programs are not motivating enough to ensure compliance after completion of the program (Lin et al., 2007; Seo et al., 2012; Skelton et al., 2005). The LiFE program developed by Clemson et al. (2012) has proven to be effective in reducing the risk of falls in older adults who have already experienced a fall. Furthermore, the program incorporates meaningful activities into everyday routines, ensuring that participants make a lifestyle change and therefore continue the program upon completion of the study. While the LiFE program has proven effective in community dwelling older adults who have experienced a fall, it has not been studied as to whether the program is effective in those who have not experienced a fall. This study aimed to examine if the LiFE program is as effective in reducing fall risk and increasing fall efficacy for non-fallers as it is for fallers. While results were inconclusive, the overall feedback for the program and integrated exercises were positive.

With a growing population of aging adults, fall prevention is a growing topic in the field of occupational therapy. Integrated exercise can be an effective client-centered intervention for fall prevention. By using integrated exercise, occupational therapists who work with older adults can include fall prevention and still emphasize the importance of engaging in meaningful activities. Therefore, occupational therapists are encouraged to implement lifestyle-integrated programs, such as the LiFE program, to facilitate successful aging in older adults.

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APPENDIX A
IRB APPROVAL LETTER

DOMINICAN UNIVERSITY of CALIFORNIA 1890

January 21, 2015

Anna Lee
50 Acacia Ave.
San Rafael, CA 94901

Dear Anna:

I have reviewed your proposal entitled *The Effectiveness of the LiFE Program for Fallers and Non-fallers* submitted to the Dominican University Institutional Review Board for the Protection of Human Participants (IRBPHP Application, #10307). I am approving it as having met the requirements for minimizing risk and protecting the rights of the participants in your research.
In your final report or paper please indicate that your project was approved by the IRBPHP and indicate the identification number.
I wish you well in your very interesting research effort.
Sincerely
Martha Nelson, Ph.D.
Associate Vice President for Academic Affairs
Chair, IRBPHP

cc: Kitsum Li

Institutional Review Board for the Protection of Human Subjects

Office of the Associate Vice President for Academic Affairs • 50 Acacia Avenue, San Rafael, California 95901-2298 • 415-257-1310

www.dominican.edu

APPENDIX B
LETTER OF PERMISSION TO IMPLEMENT THE LIFE PROGRAM

On 6 Jul 2014, at 6:29 am, "Li, Kitsum" <kitsum.li@dominican.edu> wrote:

Dr. Clemson,
I just received the LIFE manual and participant's manual. Thank you.
I have a question regarding the participant's manual, I know it is copyrighted to the authors including yourself. Will you grant us permission to make photocopy of the manual to the participants? The cost to purchase each individual manual with over US$20 per booklet is cost prohibited for our students to carry out the study. I hope that there is other solution for us to run the program cost-effectively.
Thank you for your kind consideration.

Kitsum Li, OTD, OTR/L
Assistant Professor
Department of Occupational Therapy
Dominican University of California
Kitsum.li@dominican.edu
415-458-3753

---------- Forwarded message ----------
From: Lindy Clemson <lindy.clemson@sydney.edu.au>
Date: Sat, Jul 5, 2014 at 1:35 PM
Subject: Re: Study?
To: "Li, Kitsum" <kitsum.li@dominican.edu>
For research yes
Lindy
Sent from my iPhone

APPENDIX C
PERMISSION TO USE MoCA

Hello Courtney,

Thank you for your interest in the MoCA©.

You are welcome to use the MoCA© Test as you described below with no further permission requirements.

No changes or adaptations to the MoCA© Test and instructions are permitted.

All the best,

Kathleen Gallant, MSOT
Occupational Therapist/Psychometrician
On behalf of DrZiadNasreddine, Neurologist, MoCA© Copyright Owner
CEDRA: Center for Diagnosis and Research on Alzheimer's disease
4896 Taschereau Blvd, suite 250, Greenfield Park, J4V 2J2, Québec, Canada
Tel: 450-672-1931 ext: 285 Fax: 450-672-1443
kathleen.gallant@cedra.ca
www.mocatest.org
www.cedra.ca

From: Life Group [mailto:dulifegroup@gmail.com]
Sent: 20 novembre 2014 7:28
To: info@mocatest.org
Cc: kitsum.li@dominican.edu
Subject: Request for permission to use Montreal Cognitive Assessment (MoCA) in students' master's capstone project

Dear Dr. Nasreddine,
We are writing to request permission to use the Montreal Cognitive Assessment (Nasreddine, 2014) in our master's research study examining the effectiveness of a lifestyle integrated exercise program for older adult fallers and non-fallers. This project is part of a graduate capstone project requirement in occupational therapy at Dominican University of California

In this program, we will be teaching older adults exercises that they can integrate into functional activities and everyday life. Our inclusion criteria require our participants to have minimal cognitive deficits. We believe that MoCA would be an appropriate cognitive screening tool for our project.

Our capstone project is being supervised by, Kitsum Li, OTD, OTR/L, Occupational Therapy Department, Dominican University of California, San Rafael, CA, 94901.
If this request to use MoCA in our study meets with your approval, please send us your approval by replying to this email at dulifegroup@gmail.com. If you have any questions, please do not hesitate to contact our group or our faculty advisor, Dr. Kitsum Li, at kitsum.li@dominican.edu or 415-458-3753.

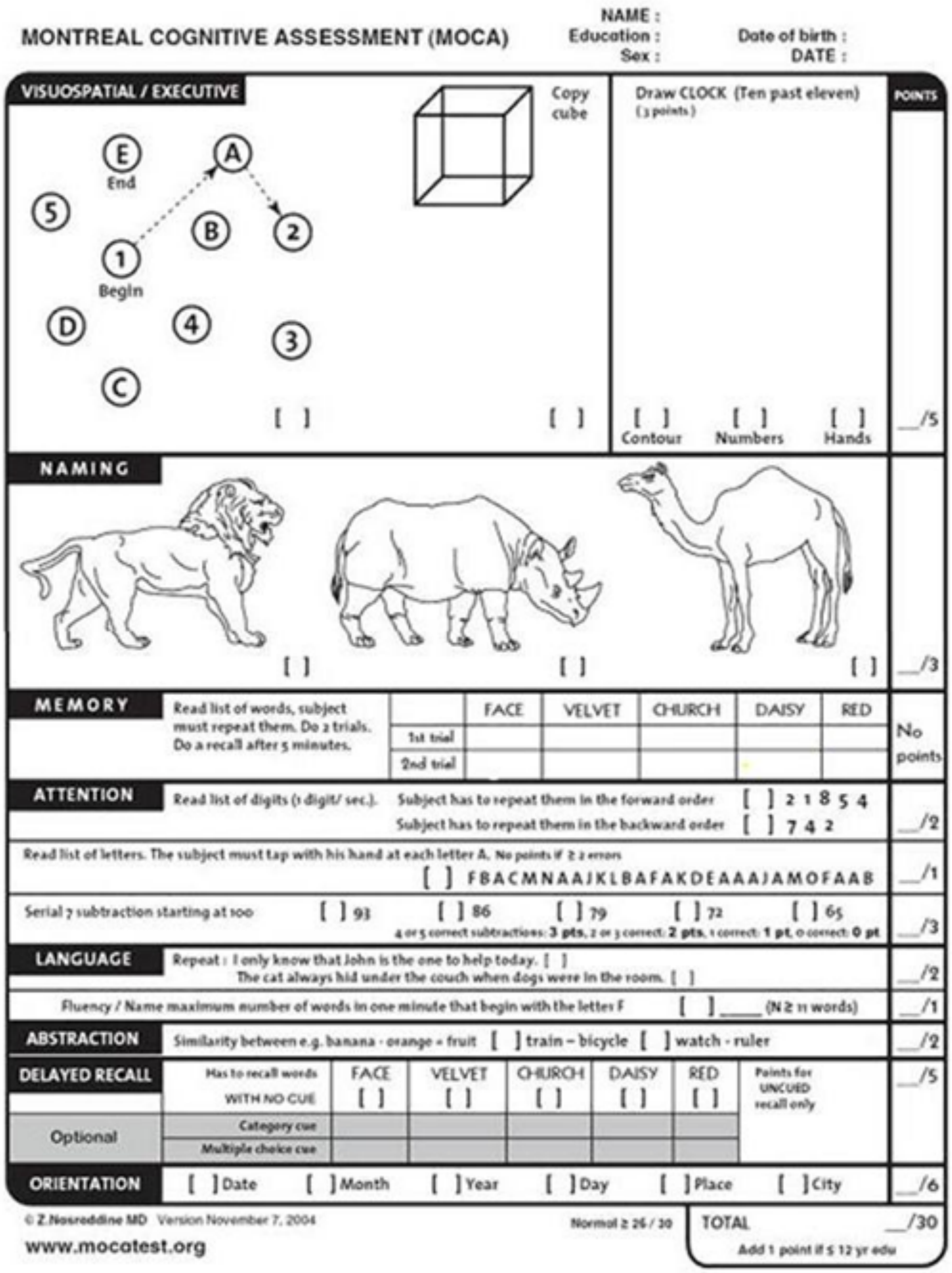
Thank you for your consideration to this request.

Sincerely yours,

Courtney Beyer
Anna Lee
Sienna Anderson
Jessica Lim

APPENDIX D
MoCA ASSESSMENT

Montreal Cognitive Assessment (MoCA) 7.1


MONTREAL COGNITIVE ASSESSMENT (MOCA)

NAME :
Education :
Sex :
Date of birth :
DATE :

		POINTS
VISUOSPATIAL / EXECUTIVE	(E) End (A) (5) (B) (2) (1) Begin (D) (4) (3) (C) [ ] — Copy cube [ ] — Draw CLOCK (Ten past eleven) (3 points) [ ] Contour [ ] Numbers [ ] Hands	__/5
NAMING	[ ] [ ] [ ]	__/3
MEMORY	Read list of words, subject must repeat them. Do 2 trials. Do a recall after 5 minutes.	No points
ATTENTION	Read list of digits (1 digit/ sec.). Subject has to repeat them in the forward order [ ] 2 1 8 5 4; Subject has to repeat them in the backward order [ ] 7 4 2	__/2
	Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors [ ] F B A C M N A A J K L B A F A K D E A A A J A M O F A A B	__/1
	Serial 7 subtraction starting at 100 [ ] 93 [ ] 86 [ ] 79 [ ] 72 [ ] 65 — 4 or 5 correct subtractions: **3 pts**, 2 or 3 correct: **2 pts**, 1 correct: **1 pt**, 0 correct: **0 pt**	__/3
LANGUAGE	Repeat : I only know that John is the one to help today. [ ] The cat always hid under the couch when dogs were in the room. [ ]	__/2
	Fluency / Name maximum number of words in one minute that begin with the letter F [ ] ____ (N ≥ 11 words)	__/1
ABSTRACTION	Similarity between e.g. banana - orange = fruit [ ] train – bicycle [ ] watch - ruler	__/2
DELAYED RECALL	Has to recall words WITH NO CUE: FACE [ ] VELVET [ ] CHURCH [ ] DAISY [ ] RED [ ] — Points for UNCUED recall only	__/5
Optional	Category cue; Multiple choice cue	
ORIENTATION	[ ] Date [ ] Month [ ] Year [ ] Day [ ] Place [ ] City	__/6

	FACE	VELVET	CHURCH	DAISY	RED
1st trial					
2nd trial					

© Z.Nasreddine MD Version November 7, 2004
www.mocatest.org
Normal ≥ 26 / 30
TOTAL __/30
Add 1 point if ≤ 12 yr edu

APPENDIX E
LIFE PROGRAM FLIER

Want to Improve Your Strength and Balance?

- Join the LiFE (Lifestyle-integrated Functional Exercise) program led by Dominican graduate students
- Help increase your strength and balance without a gym membership
- The LiFE program will help you integrate exercise into your daily activities.
- Participants must be 65 or older, and walk either independently with or without a single point cane only.

Contact us at dulifegroup@gmail.com or 415-458-3753

APPENDIX F
CONSENT FORM TO BE A RESEARCH PARTICIPANT

DOMINICAN UNIVERSITY OF CALIFORNIA

1. I understand that I am being asked to participate as a participant in a research study designed to assess whether the Lifestyle Integrated Exercise (LiFE) program is effective in fall prevention. The study will also assess whether the LiFE program will improve fall self-efficacy, which is an individual's confidence in his or her ability to avoid a fall. This research is part of Anna Lee, Courtney Beyer, Sienna Anderson, and Jessica Lim's Master Capstone research project in the occupational therapy program at Dominican University of California. This research project is being supervised by Kitsum Li, OTD, OTR/L, Dominican University of California.

2. I understand that participation in this research will involve taking part in an initial screening and assessment session. I will then participate in one-hour training sessions, once a week for 5 weeks in which I will be taught the key concepts of balance and strength activities of the LiFE program. In these sessions, I will identify which strength and balance activities I can implement independently throughout the week. I will also be provided with a Participant's Manual to describe the components of the program.

3. I acknowledge that I am expected to implement these strength and balance activities multiple times throughout the day at home, and in various environments. I will be provided with an Activity Planner for both strength and balance activities in which I will record daily, how often, when, and where I complete these activities. I will also be provided with an Activity Counter form in which I will record the number of times I perform a particular activity on a specified day. I understand that I will have to continue to participate in the LiFE program for three months after completion of the training. Six weeks following the completion of the training, I will receive a booster phone call to see how I am doing with the activities.

4. I understand that my participation in this study is completely voluntary and I am free to withdraw my participation at any time.

5. I have been made aware that I will be given four balance and strength assessments, The Timed Up and Go Test, The Single Leg Stand Test, The Chair-Stand Test, and the Functional Reach Test. These will be administered before the program, one week after completion of the program, and three months after completion of the program. The Timed Up and Go test requires me to get up from a chair while holding a cup of water and walk a round trip of 10 feet. The Functional Reach Test requires that I stand, reach my arm out in front of me and then reach forward as far as I can without falling. The reaching distance from where my hand begins and where it ends will be measured with a ruler. The Single-leg stand requires that I stand with my arms crossed, and then lift one leg up. The tester will time how long I can stand on each of my

legs. The Chair-Stand Test measures lower body strength and fitness. The Chair-Stand Test requires me to begin seated with arms crossed against my chest. I will then stand up from the chair, while maintaining a straight back, and then sit back down as many times as possible within thirty seconds.
In addition to the balance and strength assessments, I will also complete the Activities-Specific Balance Confidence Scale as well as the Patient Reported Outcomes Measurement Information System (PROMIS) global health and physical function assessment. I will complete these questionnaires before the LiFE program, one week after completion, and three months after completion of the program. The Activities-Specific Balance Confidence Scale is a 16-question self-report survey that will be used to report my fall self-efficacy. The PROMIS global health assessment is a ten-item questionnaire in which I will rate the quality or frequency for various occupations. I will rate factors such as the amount of physical pain I experience, how I feel about the quality of my relationships, and how I would rate my quality of life.The PROMIS physical function assessment is a forty-five item questionnaire in which I will rate my level of difficulty in performing certain activities such as my ability to climb five steps. I will rate how much my physical ability limits my participation in certain activities such as my ability to travel out of town for an overnight stay.All personal references and identifying information will be eliminated when these data are analyzed, and I understand that all forms will be identified by numerical code only. The master list for these codes will be kept by the researchers in a locked file, separate from the forms. The master list and all assessment forms will be seen only by the researchers and their faculty advisor. One year after the completion of the research, all written and recorded materials will be destroyed.

6. I am aware that, by request, I will be provided with a written summary of the relevant findings and conclusions of this project. Such results will not be available until December 1, 2015.

7. Benefits: The LiFE program is designed to prevent falls in older adults. Participants in the past have seen improvement after participating in this program because of the way each activity is integrated into everyday activities. I understand that I may see improvement in balance, strength, and function. These improvements will not only benefit me physically, but emotionally and psychologically as well. In addition, I will be allowed to keep the manual given to me and I can continue with the activities as shown in the manual, if I choose to.

8. Risks and/or Discomforts: I understand that although the LiFE program is designed to prevent falls in older adults, because I will be learning balance and strengthening activities, there is a risk that I could fall during one of our sessions. I also understand that my participation may involve psychological discomfort, as some participants may progress faster than others in the program, or have an easier time doing certain activities. I understand that the researchers will be very careful preventing me from falling and experiencing emotional discomfort during the sessions. I

understand that I have the right to stop the activities and withdraw from the program without consequence.

9. I understand that if I have any further questions about the study, I may contact the primary research supervisor, Kitsum Li, OTD, OTR/L at (415)-458-3753. If I have further questions or comments about participation in this study, I may contact the Dominican University of California Institutional Review Board for the Protection of Human Participants (IRBPHP), which is concerned with the protection of volunteers in research projects. I may reach the IRBPHP Office by calling (415) 482-3547 and leaving a voicemail message, by FAX at (415)257-0165 or by writing to the IRBPHP, Office of the Associate Vice President for Academic Affairs, Dominican University of California, 50 Acacia Avenue, San Rafael, CA 94901.

10. All procedures related to this research project have been satisfactorily explained to me prior to my voluntary election to participate.

I HAVE READ AND UNDERSTAND ALL OF THE ABOVE EXPLANATION REGARDING THIS STUDY. I VOLUNTARILY GIVE MY CONSENT TO PARTICIPATE. A COPY OF THIS FORM HAS BEEN GIVEN TO ME FOR MY FUTURE REFERENCE.

____ ____________

Signature Date

APPENDIX G
RESEARCH PARTICIPANT'S BILL OF RIGHTS

DOMINICAN UNIVERSITY of CALIFORNIA
RESEARCH PARTICIPANT'S BILL OF RIGHTS

Every person who is asked to be in a research study has the following rights:

1. To be told what the study is trying to find out;

2. To be told what will happen in the study and whether any of the procedures, drugs or devices are different from what would be used in standard practice;

3. To be told about important risks, side effects or discomforts of the things that will happen to her/him;

4. To be told if s/he can expect any benefit from participating and, if so, what the benefits might be;

5. To be told what other choices s/he has and how they may be better or worse than being in the study;

6. To be allowed to ask any questions concerning the study both before agreeing to be involved and during the course of the study;

7. To be told what sort of medical treatment is available if any complications arise;

8. To refuse to participate at all before or after the study is stated without any adverse effects. If such a decision is made, it will not affect her/his rights to receive the care or privileges expected if s/he were not in the study.

9. To receive a copy of the signed and dated consent form;

10. To be free of pressure when considering whether s/he wishes to agree to participate in the study;

11. To receive the same individualized, quality therapy care regardless of her/his status and group assignment.

If you have other questions regarding the research study, you can contact the research advisor Kitsum Li, at (415) 458-3753 or email Kitsum.li@dominican.edu. You may also contact the Institutional Review Board for the Protection of Human Subjects (IRBPHS). The Dominican University of California IRBHS can be reached by telephoning the Office of Academic Affairs at (415) 257-0168 or by writing to the Associate Vice President for Academic Affairs, Dominican University of California, 50 Acacia Avenue, San Rafael, CA. 94901.

APPENDIX H-1
STRENGTH TRAINING ACTIVITY PLANNER

Code Number:

LiFE Activity Planner: strength training. Week starting / /

Check if done

Strength Principle	**Strength Activity**	**Example of daily tasks.** **How, when and where?**	M	T	W	Th	F	S	Su
Bend your knees	Bend knees								
Sit to stand	Normal chair								
	Low chair								
On your toes	Stand on toes								
	Walk on toes								
On your heels	Stand on heels								
	Walk on heels								
Up the stairs	Up stairs								
Move sideways	Step sideways								
Tighten muscles	Move ankles								
	Bend/ straighten knees								
	Tighten/ relax buttocks								

APPENDIX H-2
BALANCE TRAINING ACTIVITY PLANNER

Code Number:

LiFE Activity Planner: balance training. Week starting / /

Check if done

Balance Principle	**Balance activity**	**Example of daily tasks.** **How, when and where?**	M	T	W	Tr	F	S	Su
Decrease base of support	Tandem stand								
	Tandem walk								
	One-leg stand								
Shifting weight and moving to the limits of stability	Leaning side to side								
	Leaning forwards and backwards								
Stepping over objects	Stepping forwards and backwards								
	Stepping side to side								

APPENDIX I
ACTIVITY COUNTER

Code number:

LiFE Activity Counter. Week starting: / /

Activity	**Day**	**Count**

Have you had any problems while doing any of the activities in this program?

Yes/No

If yes, please give details.

APPENDIX J
BOOSTER PHONE CALL SCRIPT

Code Number:

BOOSTER PHONE CALL SCRIPT

- Discuss any difficulties participants may be having with the program and to provide a sounding board for them to problem-solve.
- Discuss changes participants have made to their day in order to incorporate the balance and strength activities.
- Discuss upgrading activities with participants to keep them challenging themselves.
- Reinforce the principles of the LiFE program.
- Encourage and motivate participants to continue with the program and to be more active.

Document your conversation with the participant:

Person completing the phone call: Date:

APPENDIX K
BALANCE ASSESSMENTS FORM

LiFE Balance Assessments Form

Code Name: **Facility: A B**

Functional Reach Test

	Pre-test	**Post-test**	**Follow-up**
Date			
Trial 1			
Trial 2			
Trial 3			
Average			
Administrator			

Timed Up and Go

Use of a walking aid? Circle One	**Yes** **What type:**
	No

	Pre-test	**Post-test**	**Follow-up**
Date			
TUG (Manual)			
Administrator			

Code Name:

One-Leg Stand Test

	Pre-test	**Post-test**	**Follow-up**
Date			
Left Leg Time			
Right Leg Time			
Administrator			

Chair-stand Test

	Pre-test	**Post-test**	**Follow-up**
Date			
Number of Stands			
Administrator			

APPENDIX L
The Activities-specific Balance Confidence (ABC) Scale

Code name: **Date:** **Administrator:**

The Activities-specific Balance Confidence (ABC) Scale*
For each of the following activities, please indicate your level of self- confidence by choosing a corresponding number from the following rating scale:

0%	10	20	30	40	50	60	70	80	90	100%
no confidence										completely confident

"How confident are you that you will not lose your balance or become unsteady when you…
completely confident

1. How confident are you that you will not lose your balance or become unsteady when you walk around the house? ____%
2. How confident are you that you will not lose your balance or become unsteady when you walk up or down stairs? ____%
3. How confident are you that you will not lose your balance or become unsteady when you bend over and pick up a slipper from the front of a closet floor ____%
4. How confident are you that you will not lose your balance or become unsteady when you reach for a small can off a shelf at eye level? ____%
5. How confident are you that you will not lose your balance or become unsteady when you stand on your tiptoes and reach for something above your head? ____%
6. How confident are you that you will not lose your balance or become unsteady when you stand on a chair and reach for something? ____%
7. How confident are you that you will not lose your balance or become unsteady when you sweep the floor? ____%
8. How confident are you that you will not lose your balance or become unsteady when you walk outside the house to a car parked in the driveway? ____%
9. How confident are you that you will not lose your balance or become unsteady when you get into or out of a car? ____%
10. How confident are you that you will not lose your balance or become unsteady when you walk across a parking lot to the mall? ____%

11. How confident are you that you will not lose your balance or become unsteady when you walk up or down a ramp? ____%

12. How confident are you that you will not lose your balance or become unsteady when you walk in a crowded mall where people rapidly walk past you? ____%

13. How confident are you that you will not lose your balance or become unsteady when you are bumped into by people as you walk through the mall?____%

14. How confident are you that you will not lose your balance or become unsteady when you … step onto or off an escalator while you are holding onto a railing? ____%

15. How confident are you that you will not lose your balance or become unsteady when you step onto or off an escalator while holding onto parcels such that you cannot hold onto the railing? ____%

16. How confident are you that you will not lose your balance or become unsteady when you walk outside on icy sidewalks? ____%

*Powell, LE & Myers AM. The activities-specific balance confidence (ABC) scale. J Gerontol Med Sci 1995; 50(1): M28-34.

APPENDIX M
PROMIS GLOBAL HEALTH ASSESSMENT

Code Name: **Date:**

PROMIS v.1.1 - Global

Global Health

Please respond to each item by marking one box per row.

		Excellent	Very good	Good	Fair	Poor
Global01	In general, would you say your health is:	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
Global02	In general, would you say your quality of life is:	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
Global03	In general, how would you rate your physical health?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
Global04	In general, how would you rate your mental health, including your mood and your ability to think?...	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
Global05	In general, how would you rate your satisfaction with your social activities and relationships?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
Global09	In general, please rate how well you carry out your usual social activities and roles. (This includes activities at home, at work and in your community, and responsibilities as a parent, child, spouse, employee, friend, etc.)...................	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
		Completely	Mostly	Moderately	A little	Not at all
Global06	To what extent are you able to carry out your everyday physical activities such as walking, climbing stairs, carrying groceries, or moving a chair?..	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1

In the past 7 days…

		Never	Rarely	Sometimes	Often	Always
Global10	How often have you been bothered by emotional problems such as feeling anxious, depressed or irritable?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

		None	Mild	Moderate	Severe	Very severe
Global08	How would you rate your fatigue on average?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Global07	How would you rate your pain on average?..................	☐ 0 No pain	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 10 Worst imaginable pain

APPENDIX N
PROMIS PHYSICAL FUNCTION ASSESSMENT

Code Name: **Date:**

PROMIS - Ca Bank v1.1 – Physical Function

Physical Function

Please respond to each item by marking one box per row.

		Without any difficulty	With a little difficulty	With some difficulty	With much difficulty	Unable to do
PFA8	Are you able to move a chair from one room to another?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA9	Are you able to bend down and pick up clothing from the floor?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA11	Are you able to do chores such as vacuuming or yard work?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA12	Are you able to push open a heavy door?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA13	Are you able to exercise for an hour?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA14	Are you able to carry a heavy object (over 10 pounds)?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA18	Are you able to use a hammer to pound a nail?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA19	Are you able to run or jog for two miles?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA21	Are you able to go up and down stairs at a normal pace?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA24	Are you able to climb several flights of stairs?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA25	Are you able to do yard work like raking leaves, weeding, or pushing a lawn mower?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA26	Are you able to do two hours of physical labor?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1

Code Name: **Date:**

PROMIS - Ca Bank v1.1 – Physical Function

		Without any difficulty	With a little difficulty	With some difficulty	With much difficulty	Unable to do
PFA27	Are you able to run on uneven ground?...	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA29	Are you able to pull heavy objects (10 pounds) towards yourself?......................	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA31	Are you able to get up off the floor from lying on your back without help?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA41	Are you able to squat and get up?..........	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA42	Are you able to carry a laundry basket up a flight of stairs?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA53	Are you able to run errands and shop?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA56	Are you able to get in and out of a car?.....	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFB10	Are you able to climb up five steps?..........	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFB11	Are you able to wash dishes, pots, and utensils by hand while standing at a sink?..	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFB12	Are you able to make a bed, including spreading and tucking in bed sheets?......	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFB13	Are you able to carry a shopping bag or briefcase?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFB17	Are you able to put on and take off your socks?...	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFB24	Are you able to run a short distance, such as to catch a bus?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFB32	Are you able to stand unsupported for 10 minutes?..	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1

Code Name: **Date:**

PROMIS - Ca Bank v1.1 – Physical Function

		Without any difficulty	With a little difficulty	With some difficulty	With much difficulty	Unable to do
PFB42	Are you able to stand unsupported for 30 minutes?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
		Not at all	**Very little**	**Somewhat**	**Quite a lot**	**Cannot do**
PFA1	Does your health now limit you in doing vigorous activities, such as running, lifting heavy objects, participating in strenuous sports?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA2	Does your health now limit you in exercising regularly?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA3	Does your health now limit you in bending, kneeling, or stooping?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA4	Does your health now limit you in doing heavy work around the house like scrubbing floors, or lifting or moving heavy furniture?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA5	Does your health now limit you in lifting or carrying groceries?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFA6	Does your health now limit you in bathing or dressing yourself?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFB1	Does your health now limit you in doing moderate work around the house like vacuuming, sweeping floors or carrying in groceries?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFB3	Does your health now limit you in putting a trash bag outside?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFB5	Does your health now limit you in hiking a couple of miles on uneven surfaces, including hills?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFB43	Does your health now limit you in taking care of your personal needs (dress, comb hair, toilet, eat, bathe)?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1

Code Name: **Date:**

PROMIS - Ca Bank v1.1 – Physical Function

		Not at all	Very little	Somewhat	Quite a lot	Cannot do
PFB44	Does your health now limit you in doing moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf?..........................	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFB46	Does your health now limit you in doing housework or jobs around the house?........	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFB47	Does your health now limit you in doing recreational activities which require little exertion (e.g., card playing, knitting, etc.)?..	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFB49	Does your health now limit you in going for a short walk (less than 15 minutes)?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFB51	Does your health now limit you in participating in active sports such as swimming, tennis, or basketball?...............	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFB52	Does your health now limit you in pursuing your hobbies or other leisure activities?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
PFB55	Does your health now limit you in traveling out of town for an overnight stay?	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1
		No difficulty at all	**A little bit of difficulty**	**Some difficulty**	**A lot of difficulty**	**Can't do because of health**
PFB50	How much difficulty do you have doing your daily physical activities, because of your health?...	☐ 5	☐ 4	☐ 3	☐ 2	☐ 1